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ABSTRACT

This curriculum guide, which was validated by vocational teachers and mechanics in the field, describes the competencies needed by entry-level automotive mechanics. This guide lists 15 competencies; for each competency, various tasks with their performance objective, student learning experiences, suggested instructional techniques, instructional materials, and resources are provided. The curriculum guide also includes articulated competency/skill and task lists, an employability skills charts crosswalk, a list of basic hand tools needed by mechanics, and a bibliography. These materials are intended to assist teachers in secondary and postsecondary vocational programs in developing a course of study, structuring learning sequences, determining standards of performance, and locating resources. (KC)

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AUTOMOTIVE MECHANICS

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AUTOMOTIVE MECHANICS

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FOREWORD

An essential element of any curriculum or training program is a validated task list. Automobile technician instructors need a well-developed task list that serves as a solid base for course of study outlines and facilitates communication and articulation of their training programs with other institutions in the region.

The task lists in this guide were validated for content accuracy and completeness using detailed job/task analysis approaches and methods. Groups of recognized content experts in each specialty area of automobile repair and representative of a cross section of the automotive industry and vocational education nationwide, were called on to develop and validate these task lists. Validation was also achieved by surveying groups of working technicians, certified by the National Institure for Automotive Service Excellence (ASE) in each specialty area covered in these task lists. This population was chosen, (rather than attempting to survey the entire universe of automobile technicians), to identify tasks performed by recognized competent automotive service personnel.

Validated competencies have been utilized in curriculum design by both the Arizona Department of Education and the Community Colleges in Arizona. A major effort was made by both agencies to compile the lists of competencies into one list. Now, one articulated list includes all validated competencies for an entire program area.

This one list was accomplished by a group of educators. Representatives included: members of the State Board of Education, Vocational Committee to the Board, State Community College Board staff, Community College administrators and instructors, Arizona Department of Education Vocational staff, Northern Arizona University Curriculum Project Director, and high school teachers from the entire state.

During the articulation process, competencies and tasks were changed to enhance readability and continuity. In some instances, two or more tasks were combined into one task if they were similar. Other tasks were edited and modified for clarity and conciseness. Reorganization of competencies and tasks was done to sequence their order more logically. In this process, no competencies or tasks were omitted; however, they may have been combined with others, modified, or sequenced.

A new feature is the format which is designed for individual student use. The teacher can duplicate the pages directly from this curriculum guide which shows the COMPETENCY/SKILL, TASK, PERFORMANCE OBJECTIVE, and STUDENT LEARNING EXPERIENCES.

ACKNOWLEDGEMENTS

The Automotive Mechanics Competency Based Curriculum Guide is the result of many people working together to insure quality curriculum for students seeking education and training in the Automobile Technician occupations.

A committee of educators and business people was assigned the responsibility of determining if existing curriculum could be adapted or adopted to meet our needs in Arizona. The committee determined that, in large part, an existing curriculum from the State of Virginia could be used.

The development of this Instructional Guide required personal dedication from its writing staff and project participants. For their commendable efforts in dedication, time, and expertise, this recognition is given:

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Jerry Peterson
Flowing Wells High School

Larry Lamphere, Automotive instructor, Flagstaff High School, for his assistance with the final review.

Appreciation is also expressed to:

Virginia Department of Education, Vocational and Adult Education Group for the use of their COMPETENCY-BASED GUIDE IN AUTOMOTIVE MECHANICS AND SERVICING. From this excellent guide, a large amount of tasks were adopted for our project.

Special thanks goes to Dave Muehlbauer, Curriculum Coordinator for Arizona Department of Education for his part in coordination of the guide and dedication to its development in a timely and professional manner. Direction and leadership for the guides' development was given by Kenneth Thompson, State Supervisor of Trade and Industrial Education.

We are grateful to the entire staff of the Arizona Center for Vocational Education for their support, concern and assistance. Special thanks to the Curriculum Unit: Dr. Jerry R. Cox, Nancy F. Dillon, Kathi Jeffers, Cass Sandbakken, and the two computer input operators, Barbara Oftedahl and Sue Peters. In addition, we are grateful to Kathy Dunn for her leadership and assistance in getting the final curriculum guide completed, and Carole Ferlazzo for reviewing the curriculum for equity.

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VALIDATED COMPETENCIES FOR CAREERS

IN THE AUTOMOTIVE FIELD

1.0 Lubricates and maintains vehicle(s) and installs accessories:

- 1.1 Inspects and cleans automobiel interior
- 1.2 Changes oil and filter(s)
- 1.3 Lubricates vehicle and equipment
- 1.4 Performs road service
- 1.5 Picks up stalled vehicle/cannot be taught at secondary level
- 1.6 Services vehicle with fuel or oil
- 1.7 Winterizes vehicles
- 1.8 Installs minor accessories
- 1.9 Performs vehicle pre-delivery inspection
- 1.10 Remove and replace alternator/generator
- 1.11 Inspects, adjusts, replaces fan belts

2.0 Demonstrates knowledge of vehicle evaluation and inspection:

- 2.1 Prepares inspection report(s)
- 2.2 Performs inspections of vehicle conditions
- 2.3 Performs inspection of vehicle lighting system(s)
- 2.4 Inspects vehicle mirrors
- 2.5 Inspects tires and wheels
- 2.6 Inspects and tests windshield-wiper motor, blades and arms
- 2.7 Performs vehicle pre-delivery inspection
- 2.8 Inspects maintenance procedure(s)
- 2.9 Directs quality checks of vehicle after maintenance
- 2.10 Analyzes maintenance reports on vehicles
- 2.11 Estimates cost of vehicle repair(s)
- 2.12 Analyzes cause of vehicle malfunction

3.0 Directs maintenance and control functions:

- 3.1 Initiates and completes work order(s)
- 3.2 Initiates request for part(s)
- 3.3 Prepares report(s) for vehicle defect(s)
- 3.4 Inspects lubrication and service guide
- 3.5 Follows up on requisition(s)
- 3.6 Completes requests for procurement of parts
- 3.7 Enters work performed on work order(s)
- 3.8 Determines actual cost of vehicle repair(s)
- 3.9 Records and processes records on vehicles being serviced and repaired
- 3.10 Completes forms when servicing vehicle(s)
- 3.11 Completes labor time cards
- 3.12 Completes unsatisfactory report(s)
- 3.13 Spot checks service orders

4.0 Performs engine overhaul activities:

- 4.1 Performs compression cylinder test
- 4.2 Performs cylinder leakage test
- 4.3 Steam cleans engine(s)
- 4.4 Removes and replaces engine

4.5 Disassembles, cleans, and inspects engine(s)
4.6 Cleans engine parts and checks
4.7 Diagnoses valve train and head malfunctions
4.8 Grinds valves
4.9 Reconditions cylinder head
4.10 Performs operational inspections of engine lubrication system(s)
4.11 Inspects and corrects bearing fit
4.12 Inspects crankshaft and connecting rod assembly using micrometers and other equipment
4.13 Replaces crankshafts and bearings
4.14 Replaces ring(s) on piston(s)
4.15 Replaces piston(s)
4.16 Replaces connecting rods and bearings
4.17 Inspects head for warp
4.18 Replaces camshaft
4.19 Replaces camshaft bearings
4.20 Replaces timing gears and chain
4.21 Replaces flywheel
4.22 Replaces oil pump
4.23 Replaces valve lifters
4.24 Replaces gaskets and seals
4.25 Replaces and repairs cylinder head
4.26 Adjusts valves
4.27 Replaces pan and valve cover(s)
4.28 Replaces engine mounts
4.29 Repairs or services crankcase ventilation system
4.30 Inspects or replaces exhaust manifold
4.31 Replaces muffler
4.32 Replace tail pipe assemblies
4.33 Performs operational inspections of postive crankcase ventilation system(s)
4.34 Inspects exhaust system(s)

5.0 Maintains and repairs power trains:

5.1 Adjusts external shift linkage on manual transmission
5.2 Inspects drive shafts, U-joints and center bearings
5.3 Diagnoses differential malfunctions
5.4 Diagnoses manual transmission operation
5.5 Replaces universal joints
5.6 Replaces driveline seals
5.7 Replaces pinion seals
5.8 Lubricates speedometer cable, drive gear and housing
5.9 Replaces transmission mounts
5.10 Replaces clutch disc and pressure plate
5.11 Replaces pilot bearings
5.12 Replaces speedometer cable, drive gear and housing
5.13 Replaces clutch release bearing
5.14 Replaces rear-axle shaft, bearings and seal
5.15 Repairs hydraulic-type clutch
5.16 Rebuilds manual transmission
5.17 Rebuilds overdrive unit
5.18 Adjusts external shift linkage on manual transmission
5.19 Adjusts clutch
5.20 Repairs or replaces differentials

5.21 Repairs or replaces spider gear
5.22 Balances drive shaft (in car)
5.23 Analyzes and repairs electronic control circuits and components on overdrive units
5.24 Repairs, replaces or adjusts front-drive axle assemblies
5.25 Removes and replaces a propeller shaft
5.26 Road test inspections of differentials

6.0 Maintains and repairs automatic transmissions:

6.1 Adjusts shift linkage
6.2 Adjusts linkage from steering column to automatic transmission
6.3 Adjusts from engine to automatic transmission
6.4 Cleans and visually inspects transmission
6.5 Replaces or adjeuts modulator(s)
6.6 Inspects and repairs transmission cooling system
6.7 Replaces front pump, seal, and bushing
6.8 Installs automatic transmission cooler
6.9 Replaces manual transmission rear seal and bushing
6.10 Performs a road test for transmission diagnosis
6.11 Removes and isntalls automatic transmission
6.12 Makes bank adjustment (internal or external)
6.13 Services backup light switch or neutral safety switch
6.14 Services filter
6.15 Services filter and checks transmission cooling system

7.0 Maintains and repairs electrical system(s):

7.1 Performs operational inspections of electrical system(s)
7.2 Determines battery state of charge
7.2.1 Services or replaces batteries, cables, and battery box
7.2.2 Load test a battery
7.3 Locates and repairs shorted or open circuits
7.4 Measures resistance in plug wires
7.5 Analyzes malfunctions in cranking system
7.6 Repairs starter
7.7 Replaces solenoids
7.8 Evaluates alternator/generator output
7.9 Repairs generator/alternator
7.10 Tests and adjusts external- type voltage regulator
7.10.1 Tests internal-type voltage regulator
7.11 Evaluates condition of points and condenser of the primary circuit
7.12 Gaps spark plugs
7.13 Inspects secondary circuit lead wires, distributor cap and rotor
7.14 Adjusts ignition timing
7.15 Replaces points and condenser
7.15.1 Checks advance mechanisms
7.15.2 Removes, replaces, and adjusts distributor
7.15.2 Disassembles, repairs, and reassembles distributor
7.16 Analyzes electrical system performance using ohmmeter, ampmeter and voltmeter
7.17 Uses electronic engine analyzer
7.18 Diagnoses and repairs electronic ignition system(s)
7.19 Reads electrical schematics

7.20 Repairs or replaces switch(es)
7.21 Repairs or replaces fuse block assembly
7.22 Performs operational inspections of lighting
7.23 Repairs or replaces lighting system components
7.24 Adjusts headlight(s)
7.25 Replaces stop-light switch
7.26 Diagnoses and repairs direction signal circuits
7.27 Adjusts, repairs or replaces backup light
7.28 Inspects turn signals

8.0 Maintains and repairs fuel system(s):

8.1 Inspects and replaces air filter
8.2 Performs operational inspection of fuel system
8.3 Measures fuel flow and pressure
8.4 Repairs or replaces fuel line(s) and hose(s)
8.5 Cleans or replaces fuel filter
8.6 Inspects, cleans and adjusts choke unit (automatic and manual)
8.7 Overhauls 1-, 2-, or 4-barrel carburetor
8.8 Analyzes for moisture or foreign particule level in fuel system
8.9 Removes and replaces carburetor
8.10 Diagnoses and repairs fuel system malfunction
8.11 Adjusts carburetor
8.12 Removes and replaces fuel pump
8.13 Tests gas tank sending unit
8.14 Performs operational inspections of exhaust emission control system
8.15 Repairs or services exhaust emission control system
8.16 Services or repairs manifold heat control(s), heat riser(s)
8.17 Repairs or replaces fuel injector
8.18 Repairs or replaces fuel injector
8.19 Replaces electrical fuel injection computer
8.20 Reads vacuum schematic(s)
8.21 Services or replaces unitsin a vacuum system
8.22 Services or repairs turbocharger

9.0 Maintains and repairs standard and power steering units:

9.1 Static balances a tire and wheel assembly
9.1.1 Spin balance on-the-car tire and wheel
9.1.2 Computer balances tire and wheel (off-the-car)
9.2 Inspects, repacks, and adjusts front wheel bearings
9.3 Replaces belts and sets tension
9.4 Inspects and replaces steering spindle
9.5 Replaces manual steering gear components
9.6 Removes and replaces tie rod ends
9.7 Repairs upper and lower control arm assemblies (bushings and ball joints)
9.8 Repairs or replaces power steering pump
9.8.1 Repairs or replaces power steering pump
9.9 Repairs or replaces power steering components
9.10 Rebuilds power steering cylinder
9.11 Adjusts steering backlash

10.0 Maintains and repairs braking system(s):

- 10.1 Adjusts brake(s)
- 10.2 Adjusts hand brake linkage
- 10.3 Adjust hand brake external band
- 10.4 Bleeds hydraulic brake(s)
- 10.5 Free up parking brake cable(s)
- 10.6 Inspects and replaces brake pads
- 10.7 Checks disc runout and thickness
- 10.7.1 Reconditions disc brake and rotors
- 10.8 Inspects brake drum(s)
- 10.8.1 Reconditions brake drum(s)
- 10.9 Inspects, repairs or replaces self adjustor(s)
- 10.10 Diagnoses malfunctions of drum or disc service braking system
- 10.10.1 Tests vacuum power booster
- 10.11 Removes and replaces brake shoe(s)
- 10.12 Replaces disc brake pad(s)
- 10.13 Removes, reconditions, and replaces a tandem master cylinder
- 10.14 Repairs or replaces hydraulic power brake unit
- 10.15 Repairs or replaces hydraulic control valve
- 10.16 Repairs or replaces hydraulic line(s) and fitting(s)
- 10.17 Replaces brake hose(s) and line(s)
- 10.18 Replace hoses, lines, and fittings
- 10.19 Removes, reconditions, and replaces a wheel cylinder

11.0 Maintains and repairs front ends and suspension

- 11.1 Performs visual inspections of suspension sytem
- 11.2 Balances wheels and tires
- 11.3 Inspects wheel bearings
- 11.4 Adjusts and repacks front wheel bearing(s)
- 11.5 Repairs or replaces front wheel bearing grease seal(s)
- 11.6 Lubricates ball joints
- 11.7 Lubricates the front and rear suspension
- 11.8 Inspects and repairs front suspension system
- 11.9 Adjusts or replaces torsion bars
- 11.10 Inspects and replaces steering damper
- 11.11 Replaces front suspension control arms and bushings
- 11.12 Inspects and replaces shock absorbers

12.0 Maintains and repairs cooling system:

- 12.1 Removes and replaces heater (water) hoses
- 12.2 Inspects, adjusts and/or replaces fan belts
- 12.3 Pressure tests cooling system
- 12.4 Checks coolant operating temperature
- 12.5 Checks coolant freezing point
- 12.6 Chemically cleans and flushes cooling system
- 12.7 Replaces heater hose(s)
- 12.8 Replaces radiator hose(s)
- 12.9 Replaces variable-speed fan
- 12.10 Replaces radiator
- 12.11 Removes, tests, and replaces thermostat
- 12.12 Tests and replaces coolant pressure cap
- 12.13 Replaces water pump
- 12.14 Solders minor leaks in radiator
- 12.15 Replaces freeze plug(s)

13.0 Maintains and repairs automobile air conditioning system(s):

- 13.1 Recharges system, using pound cans
- 13.2 Leak tests an air conditioning system
- 13.3 Diagnosis air conditioning malfunction(s)
- 13.4 Replaces compressor
- 13.5 Removes and replaces compressor shaft seal
- 13.6 Evacuates system using vacuum pump or charging system
- 13.7 Replaces condenser
- 13.8 Replaces evaporator in air conditioning unit
- 13.9 Replaces dryer
- 13.10 Replaces air conditioning fan motor
- 13.11 Replaces expansion valve
- 13.12 Replaces evaporator control valve
- 13.13 Diagnoses and repairs air conditioning electrical circuits
- 13.14 Services air conditioning control cables and switches

14.0 Maintains and repairs automobile heating system(s):

- 14.1 Diagnoses heating system malfunction(s)
- 14.2 Replaces heater defroster hose
- 14.3 Removes and replaces water control valve
- 14.4 Removes and repairs or replaces heater core
- 14.5 Services heater control component(s)
- 14.6 Removes and replaces heater core

15.0 Engine performance and drivability diagnosis, and repair:

Student should have all competencies in Area 7 and 8.

- 15.1 Connects test equipment to vehicle
- 15.2 Evaluates test equipment readings
- 15.3 Distinguishes normal/abnormal analyzer readings
- 15.4 Prepares test reports
- 15.5 Analyzes vehicle performance malfunctions
- 15.6 Replaces defective components in electrical or fuel system
- 15.7 Adjust ignition system to manufacturer's specifications
- 15.8 Adjust fuel system to manufacturer's specifications
- 15.9 Obtains vehicle computer trouble codes
- 15.10 Clears trouble codes
- 15.11 Retests vehicle

ARTICULATED COMPETENCIES/TASKS

GENERAL AUTOMOTIVE

TASK NUMBER(S)	TASK
3.8,3.10,3.11	Find necessary information in service manuals, flat rate, and parts books.
All sections	Performs various frequently used service operations quickly and effectively, adhering to recognized safety standards.
9.0,10.0,11.0	Identify internal and external parts of suspension, brakes, and steering systems.
11.3,11.4,11.5	Perform wheel bearing service procedures.
7.2	Use safety precautions in servicing electrical systems and fuel systems.
All sections	Use manufacturer's specifications in the maintenance of vehicles.
All sections	Work with fellow students in a manner that is safe and respectful.
All sections	Work with customers in a manner that is attentive and polite.
All sections	Demonstrate safe work habits.
10.1 to 10.19	Repair and recondition brake systems.
10.10	Diagnose problems of brake systems.
All sections	Sucessfully use repair manuals.

TASK NUMBER(S)	TASK
All sections	Demonstrate safe work habits.
All sections	Demonstrate proper use of all equipment related to all pertinent tasks.
4.30	Describe oil, cooling, air fuel, and exhaust delivery systems.
8.2	Identify internal and external engine parts.
3.0 and 21.0	Communicate effectively in the automotive field.
7.2, 8.3, 9.7	Use correct safety habits.
2.11, 3.1 to 3.13	Locate needed information in service and shop manuals.
4.7, 4.11, 4.12, 4.17, 4.26	Make precise measurements with common measuring devices.
3.1, to 3.13	Fill out work orders, price out labor, parts, and estimate bills.
All sections	Demonstrate a knowledge of mechanics' hand tools usage and their proper names.
All sections	Identify safety hazards, unsafe working conditions, and fire hazards.
1.3	Lubricate a chassis completely and demonstrate a knowledge of automotive lubricants.
All sections	Demonstrate a knowledge of shop manuals and where to locate service specifications and procedures.

TASK NUMBER(S)	TASK
All sections	Identify and practice shop safety rules, regulations, and habits.
10.6, 10.12	Inspects and replaces brake pads (disc brakes).
10.10	Performs operational brake inspection.
11.4	Adjusts and repacks front wheel bearing(s).
11.3	Inspects wheel bearings.
11.6	Lubricates ball joints.
11.5	Replaces front wheel bearing grease seal(s).
11.12	Replaces shock absorbers and mounting.
13.1	Inspects, refills and leaktests system with freon.
1.1	Inspects and cleans automobile interior.
1.2	Changes oil and filter(s).
1.3	Lubricates vehicle and equipment.
1.4	Performs road service.

TASK NUMBER(S)	TASK
1.5	Picks up stalled vehicle.
1.6	Services vehicle with fuel or oil.
1.7	Winterizes vehicle.
1.8	Installs minor accessories such as radios and mirrors.
4.9,4.5,4.3	Demonstrate proper and safe use of basic hand tools, cleaning and service equipment.
1.0 to 15.0	Use service/specification/parts manuals in the maintenance and service of vehicles.
4.5,4.9,8.22	Demonstrate the proper use of test equipment and precision measuring equipment.
4.6,4.10,4.11, 4.21,	Identify internal and external engine parts.
4.5	Identify basic hand tools used in automotive service.
All sections	Properly maintain and describe proper use of selected hand tools.
4.5,4.9	Describe use of selected precision tools.
All sections	Identify personal protective items and their use and safety when using automotive hand tools.
7.2	Identify the various types of appropriate personal protective items and their application in work stations and laboratories.

TASK NUMBER(S)	TASK
4.25	Explain the various types of cleaning chemicals, cleaning equipment, and safety precautions in work stations and laboratories.
9.1,11.12	Discuss safe operation of power tools, lifting equipment, welding, and cutting equipment and their maintenance.
4.0,7.0,8.0 12.0	Describe engine lubrication, cooling, air fuel, exhaust, and electrical systems of an automobile engine.
5.0,6.0,9.0, 10.0,11.0	Describe automobile suspensions, brake and steering systems, transmissions, clutches, drive lines, and differentials.
2.10	Analyzes maintenance reports on vehicle.
2.9	Inspects maintenance procedure(s).
1.9,2.7	Inspects vehicles sold by organization.
1.8	Inspects and tests windshield-wiper motor, blades and arms.
2.5	Inspects tires and wheels.
2.4	Inspects vehicle mirrors.
2.1	Prepares inspection report (s).
2.2	Performs inspections of vehicle conditions.
2.3	Performs inspection of vehicle lighting system(s).

TASK NUMBER(S)	TASK
3.10	Completes forms when servicing vehicle(s).
3.11	Completes labor time cards.
3.6	Completes requests for procurement of parts.
3.8	Determines actual cost of vehicle repair(s).
3.7	Enters work performed on work order(s).
3.1	Initiates and completes work order(s).
3.2	Initiates request for part(s).
3.4	Inspects lubrication and service guide.
3.3	Prepares report(s) of vehicle defect(s).
4.26	Adjusts valves.
4.3	Cleans engine(s).
4.34	Inspects exhaust system(s).
5.2	Inspects drive shaft, U- joints and center bearings.

TASK NUMBER(S)	TASK
2.12	Analyzes cause of vehicle failure, listed as malfunction on page 15.
6.14	Services automatic transmission.
6.15	Services filter and checks transmission cooling system.
7.24	Adjusts headlight(s).
6.15	Services or replaces battery, cables and battery carriage.
12.5	Checks coolant freezing point.
12.1	Inspects water hose(s).
12.12	Tests and replaces coolant pressure cap.
9.2	Lubricates steering box and linkage.
1.11	Replaces belts and sets tension.
10.2	Adjusts hand brake linkage.

TASK NUMBER(S)	TASK
2.12	Conducts spot checks on malfunctions.
2.9	Directs quality checks of vehicle after maintenance.
2.11	Estimates cost of vehicle repair(s).
3.9	Records and processes records on vehicles being serviced and repaired.
3.12	Completes unsatisfactory report(s).
3.5	Spot checks service orders.
3.13	Spot checks service orders.
7.19	Interpret drive train related wiring diagrams wherever necessary.
4.0, 10.0, 7.0, 8.22	Demonstrate the proper use of test equipment and precision measuring equipment.
4.0, 7.0, 8.0, 12.0	Describe engine lubrication, cooling, air fuel, exhaust, and electrical systems of an automobile engine.
5.0, 6.0, 9.0, 10.0, 11.0,	Describe automobile suspensions, brake and steering systems, transmissions, clutches, drive lines, and differentials.
3.2, 3.4, 3.6, 3.11	Find necessary information in service manuals, flat rate, and parts books.

TASK NUMBER(S)	TASK
1.0 to 15.0	Performs various frequently used service operations quickly and effectively, adhering to recognized safety standards.
9.0,10.0,11.0	Identify internal and external parts of suspension, brakes, and steering systems.
9.0,10.0,11.0	Describe the operating principles of suspension, brakes, and steering systems.
7.16,7.17	Operate electronic test equipment accurately in the process of diagnosing mechanical, electrical, and fuel system malfunctions.
7.11 to 7.13 8.1,8.2,8.6, 8.13,8.14	Evaluate internal and external ignition and fuel system parts of usability.
7.3	Identify automotive electrical components and select by function and operation items to complete basic dc circuits.
15.1 to 15.11, 7.16,7.17	Diagnose problems on modern automotive engine.
5.1 to 5.26 6.1 to 6.15	Be able to service, disassemble, repair, reassemble, and adjust automatic and standard transmissions, differentials, and drive lines in an automotive power-train assembly.

ENGINE REPAIR

TASK NUMBER(S)	TASK
12.8, 12.9, 12.13	Replaces radiator hose(s), variable-speed fan, and water pump.
12.14	Solders minor leaks in radiator.
12.11	Tests and replaces thermostat.
4.7, 4.8, 4.9, 4.17, 4.25, 2.26	Demonstrate the ability to diagnose, determine cause, and service the cylinder head and valve train of contemporary engines; Including valve, guide, and seat reconditioning and replacement.
4.11 to 4.16 4.18 to 4.24	Demonstrate the ability to diagnose, determine cause, and service the cylinder block, piston, connecting rod, camshaft of contemporary engines. Including honing, boring, crankshaft, piston, ring, and bearing service.
4.0, 8.0, 12.0	Describe the operation of the lubrication, cooling, fuel, and exhaust systems on the most common passenger cars and light truck engines.
4.12	Measure engine cylinders and crankshafts for size and serviceable condition.
4.7	Evaluate valve guides, valve timing chains, rods, pistons, rocker assemblies, and lifters, and determine which parts need reconditioning or replacement.
4.13 to 4.16 4.18 to 4.27	Assemble an engine for one of the common passenger cars or light trucks, maintaining proper clearances and settings.
4.13 to 4.16 4.18 to 4.25 4.27 to 4.32	Identify, remove, and install the internal and external components of the modern internal combustion engine.
4.1 to 4.34	Disassemble and reassemble to given specifications the overhead valve six cylinder engine.

TASK NUMBER(S)	TASK
4.1 to 4.34	Perform the necessary work to overhaul an engine.
4.0,7.0,8.0	Identify internal and external engine parts.
4.1 to 4.34	Identify, remove, and install the internal and external components of the modern combustion engine.
4.0	Describe the functions and components of an internal combustion engine.
4.1 to 4.34	Recondition internal combustion engines. Overhaul a modern automotive engine. Perform basic machine shop operations.
4.5,4.7,4.10 4.11,4.12,4.17	Disassemble and reassemble an automotive engine, name parts, measure and evaluate wear and determine needed repairs.
4.8,4.9	Grind valves, seats, and demonstrate proper use of grinding machinery and equipment.
4.26	Adjust hydraulic and solid valve lifters.
4.0,7.0,8.0	Identify and describe all the systems of the internal combustion engine.
15.1 to 15.11	Diagnose common problems that occur in the internal combustion engine.
4.4,4.28	Remove and reinstall an engine from a car.
4.6	Cleans engine parts and checks for condition.
4.7	Diagnoses valve train and head malfunctions.

TASK NUMBER(S)	TASK
4.5	Disassembles engine(s).
4.8	Grinds valves.
4.11	Inspects and corrects bearing fit.
4.17	Inspects head for warp.
4.30	Inspects or replaces exhaust manifold.
4.12	Inspects crankshaft and connecting rod assembly using micrometers and other equipment.
15.1, 15.2, 15.3	Performs cylinder balance test.
4.2	Performs cylinder leakage test.
4.10	Performs operational inspections of engine lubrication system(s).
4.4	Removes engine from vehicle.
4.16	Replaces connecting rods and bearings.
4.13	Replaces crankshaft and bearings.
4.28	Replaces engine mounts.

TASK NUMBER(S)	TASK
4.21	Replaces flywheel.
4.24	Replaces gaskets and seals.
4.22	Replaces oil pump.
4.27	Replaces pan and valve cover(s).
4.14, 4.15	Replaces rings(s) on piston(s). Replaces piston(s).
4.20	Replaces timing gears and chain.
4.25	Replace valves.
4.29	Repairs or services crankcase ventilation system.
4.23	Replaces valve lifters.
4.9	Resurfaces valve seats.
4.18, 4.19	Replaces camshaft and camshaft bearings.
4.1	Runs compression test.
12.4	Checks coolant temperature.

TASK NUMBER(S)	TASK
12.3	Checks overflow tank and accessories.
12.6	Chemically cleans and flushed cooling system.
12.9	Inspects, adjusts and/or replaces fan.
12.1	Inspects water hose(s).
12.15	Replaces freeze plug(s).
4.1 to 4.34	Perform a complete motor overhaul.
4.1 to 4.34	Understand the theory, disassembly, rebuilding, and reassembly of an internal combustion engine.
4.20	Demonstrate a knowledge of distributor, cam and crankshaft relationship.

MANUAL TRANSMISSION & DRIVELINE

TASK NUMBER(S)	TASK
5.10, 5.15	Replace a clutch on the most common cars and check flywheel runout and bell housing alignment.
5.20	Replace ring and pinion gear on most common cars and light trucks.
5.16	Overhaul a manual transmission found in the most common cars and light trucks.
5.5	Replace universal joints on the most common cars and light trucks.
5.10	Identify components of current clutch mechanisms.
5.10, 5.15	Remove and replace clutch assemblies.
5.9	Adjust clutch linkage.
5.10	Diagnose clutch problems.
5.4	Identify components of manual transmissions. Describe power flow of such such transmissions and diagnose problems.
5.16	Remove and replace manual transmission.
5.5	Identify, remove, repair, and replace drive lines.
5.3	Identify types of differential and axle assemblies. Describe power flow of such assemblies. Diagnose differential problems.

TASK NUMBER(S)	TASK
5.7, 5.14, 5.20 5.21, 5.26	Remove, repair, and replace differential and axle assemblies.
5.5	Disassemble and reassemble drive shaft universal joints and center support bearings.
5.10	Remove and replace standard transmission.
5.20	Assemble automotive differentials to factory specifications.
5.19	Measure flywheel and bellhousing runout and adjust a clutch linkage.
5.1 to 5.26	Service and repair syncromeshed transmissions, differential assemblies, drivelines, and clutch assemblies.
5.1, 5.4, 5.16	Test, service, and overhaul a manual transmission.
5.0 and 6.0	Explain the need and purpose of each component of the power train.
5.16	Disassemble, inspect, repair, and reassemble a standard transmission.
5.10, 5.15	Disassemble inspect, repair and reassemble a clutch assembly.
5.20	Disassemble, inspect, repair, and reassemble a differential assembly.
5.5	Disassemble, inspect, repair, and reassemble a drive line with U-joints.
5.1 to 5.26 6.1 to 6.15	Be able to service, disassemble, repair, reassemble, and adjust automatic and standard transmissions, differentials, and drive lines in an automotive power-train assembly.

TASK NUMBER(S)	TASK
5.18	Adjusts external shift linkage on manual transmission.
5.19	Adjusts mechanical-type clutch.
5.23	Analyzes and repairs electronic control circuits and components on overdrive units.
5.22	Balances drive shaft (in car).
5.1	Inspects shifting linkage.
5.2	Inspects drive shafts, U-joints, and center bearings.
5.8	Lubricates speedometer cable, drive gear and housing.
5.3	Performs operational inspections on differentials.
5.5	Performs operations of drive shafts, U-joints, and center bearings.
5.4	Performs operational manual transmission inspections.
5.17	Rebuilds overdrive unit.
5.16	Rebuilds manual transmission.
5.15	Repairs hydraulic-type clutch.

TASK NUMBER(S)	TASK
5.20	Repairs or replaces differentials.
5.5	Repairs or replaces slip joints or universal joints.
5.24	Repairs, replaces or adjusts front-drive axle assemblies.
5.10	Replaces mechanical-type clutch.
5.6	Replaces drive line seals.
5.11	Replaces pilot bearings.
5.14	Replaces rear-axle shaft, bearings and seal.
5.12	Replaces speedometer cable, drive gear and housing.
5.13	Replaces throw-out bearings.
5.19	Replaces transmission mounts.
5.26	Road tests inspections of differentials.
5.0 and 6.0	Describe operating principles of clutches, standard and automatic transmissions, transaxles, drivelines, rear axle assemblies, torque converters, and their related components.
5.9	Demonstrate appropriate safety precautions when servicing the above components.

TASK NUMBER(S)	TASK
5.2, 5.3, 5.4	Perform proper diagnostic procedures.
5.1, 5.4, 5.6, 5.7, 5.10, 5.13, 5.15, 5.19, 5.22 5.24	Evaluate causes of drive train failures.
5.0 and 6.0	Describe operating principles of clutches, standard and automatic transmissions, drive lines, rear axle assemblies, and torque converters.
5.1 to 5.26	Diagnose, determine cause, service, and overhaul drive train components.
9.0, 10.0, 11.0	Identify internal and external parts of suspension, brakes, and steering systems and describe their operating principles

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AUTOMATIC TRANSMISSION & TRANSAXLES

TASK NUMBER(S)	TASK
6.1	Adjusts floor shift linkage.
6.2	Adjusts linkage from steering column to automatic transmission.
6.3	Adjusts linkage from engine to automatic transmission.
6.4	Cleans and visually inspects transmission.
6.5	Diagnoses, replaces or adjusts modulator(s).
6.6	Inspects and repairs transmission cooling system.
6.7	Inspects and repairs front pump and components.
6.8	Installs automatic transmission cooler.
6.12	Makes internal repair(s) and adjustments on automatic transmission(s).
6.10	Performs operational automatic transmission inspection(s).
6.11	Removes and installs automatic transmission.
6.9	Replaces external seals, gaskets and lines on automatic transmission.

TASK NUMBER(S)	TASK
6.13	Replaces or adjusts neutral switches.
5.0 and 6.0	Describe operating principles of clutches, standard and automatic transmissions, transaxles, drivelines, rear axle assemblies, torque converters, and their related components.
5.0 and 6.0	Demonstrate appropriate safety precautions when servicing the above components.
6.10	Perform proper diagnostic procedures.
5.0 and 6.0	Describe operating principles of clutches, standard and automatic transmissions, drivelines, rear axle assemblies, and torque converters.
6.7,6.11	Remove and replace an automatic transmission.
6.7,6.11	Perform an overhaul procedure on a domestic manufacturer's automatic transmission.
6.10	Identify components of torque converter.
6.10	Describe power flow of same.
6.10	Diagnose problems of such converters.
6.7	Remove and replace torque converter.
6.10	Identify components of such transmissions. Describe power flow of same.
6.7,6.10	Diagnose problems of automatic transmissions.

TASK NUMBER(S)	TASK
6.7,6.11	Remove, repair, and replace such transmissions.
6.1,6.3,6.4, 6.5,6.6	Perform an in-car service on four different types of automatic transmissions.
6.7	Remove and replace four differnt types of automatic transmissions.
6.7	Evaluate automatic transmission parts and select replacements as necessary.
6.4 to 6.15	Disassemble, assemble, and test automatic transmissions to factory specifications.
6.7,6.9, 6.10 6.12	Diagnose, service, and repair automatic transmissions.
6.4 to 6.15	Test, service, and overhaul a typical automatic transmission.
6.10	Identify basic systems of an automatic transmission.
6.11	Remove and reinstall an automatic transmission from a vehicle.
5.1 to 5.26 6.1 to 6.15	Be able to service, disassemble, repair, reassemble, and adjust automatic and standard transmissions, differentials, and drivelines in an automotive power-train assembly.

ELECTRICAL SYSTEMS

TASK NUMBER(S)	TASK
7.27	Adjusts, repairs or replaces backup light switch(es).
7.19	Reads electrical schematics.
7.5	Analyzes malfunctions in the cranking system.
7.8	Evaluates alternator, generator and regulator output.
7.3	Locates and repairs shorts and open circuits in wiring.
7.1	Performs operational inspections of electrical system(s).

ELECTRICAL SYSTEMS

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7.5	Analyzes malfunctions in the cranking system.
7.8	Evaluates alternator, generator and regulator output.
7.3	Locates and repairs shorts and open circuits in wiring.
7.1	Performs operational inspections of electrical system(s).
7.22	Performs operational inspections of lighting system(s).
7.10	Repairs or replaces charging system regulator.
7.9	Repairs generator or alternator.
7.21	Repairs or replaces fuse block assembly.
7.23	Repairs or replaces lighting system components.
7.20	Repairs or replaces switch(es).
7.7	Repairs solenoid.

TASK NUMBER(S)	TASK
7.6	Repairs starter.
7.25	Replaces stop-light switch.
7.28	Replaces turn signal switch.
7.2	Services or replaces battery, cables and battery carriage.
7.9	Services the generator.
	Tests and repairs cruise control unit.
7.26	Tests turn signal unit.
8.13	Tests and repairs dash unit(s).
1.8	Installs minor accessories as radios and mirrors.
7.16	Diagnose electrical problems in automotive electrical components and circuits.
7.3	Solve electrical problems using Ohms law.
7.2,7.3	Use safety precautions in servicing electrical systems and fuel systems.
7.2, 7.8,7.5	Use test equipment to test a battery, a charging system, and a starting system to determine whether they are operating to manufacturer's specifications.

TASK NUMBER(S)	TASK
7.3,7.16	Performs an available volts and/or volts drop test to determine if the circuits (wires and connections) are functioning properly.
7.19	Use a wiring diagram or electrical schematic to identify and follow a particular electrical circuit.
7.5,7.8,7.13, 7.17, 7.18	Explain the operation of starting, charging, and ignition systems.
7.5,7.6,7.7, 7.8,7.9,7.10, 7.11 to 7.18	Diagnose and repair starting, charging, and ignitions systems.
7.6,7.9	Disassemble, identify, evaluate, and reassemble components of three brands of starter motors and five alternators.
7.2	Test the operation of 12 volt automotive batteries.
7.19	Read automotive electrical schematics and identify test points.
7.16,7.17	Perform diagnostic tests and make proper adjustment on electrical component problems.
7.3,7.1	Identify and evaluate automotive electrical systems.
7.5,7.6,7.8, 7.9	Service, test, and rebuild a starter and alternator.
7.3	Trace down common electrical problems.
7.2	Test and service batteries.
7.6,7.9,7.19	Disassemble and bench test an alternator, starter, and generator and trace running light circuits on the schematic.

TASK NUMBER(S)	TASK
7.3	List and explain the principles and design of the auto electrical system.
7.1,7.5,7.8, 7.16	Diagnose and make repairs to a charging system, starting systems, and to the ignition system.

STEERING AND SUSPENSION

TASK NUMBER(S)	TASK
9.11	Adjusts worm and sector in steering box.
9.4	Inspects and replaces steering spindle.
9.1	Inspects steering.
9.10	Rebuilds power steering cylinder.
9.5	Repairs or replaces manual steering components.
9.9	Repairs or replaces power steering components.
9.8	Repairs or replaces power steering pump.
9.7	Replaces pivot points on power steering.
9.6	Replaces pivot points on steering linkage.
11.9	Adjusts or replaces torsion and trunnion bars.
11.4	Adjusts and repacks front wheel bearing(s).
11.2	Balances wheels and tires.
11.10	Inspects and replaces steering damper.

TASK NUMBER(S)	TASK
11.3	Inspects wheel bearings.
11.8	Inspects and repairs front suspension system.
11.6	Lubricates ball joints.
11.7	Lubricates the front and rear suspension.
11.1	Performs visual inspections of suspension system.
11.5	Replaces front wheel bearing grease seal(s).
11.11	Replaces front suspension control arms and bushings.
11.12	Replaces shock absorbers and mounting.
5.0,6.0,9.0, 11.0	Identify internal and external parts of the automobile suspension, steering, and power train.
9.0,10.0,11.0	Describe the operating principles of suspension, brakes, and steering systems.
9.1,10.10,11.1	Perform diagnosis and inspection of suspension, brakes, and steering systems.
9.3,9.5 to 9.9 10.11 to 10.18 11.11,11.12	Remove and replace faulty components of suspension, brakes, and steering systems.
11.5,10.13 to 10.16,11.8,9.5 9.8 to 9.10	Overhaul components of suspension, brakes, and steering systems.

TASK NUMBER(S)	TASK
11.2	Perform suspension, steering alignment, and wheel balancing procedures.
9.6,9.7	Identify ball joints, control arm bushings, idler arms, tie-rod ends, and strut rod bushings in need of replacement.
	Align front and rear wheels on the most common cars.
	Test tire and wheel assemblies for radial and lateral run-out.
9.1	Use a computer balancer to balance tires.
11.8	Replace ball joints, coil springs, torsion bars, control arm bushings and/or idler arms.
11.9	Identify various types of front and rear suspension.
	Describe how components of such suspensions interact with each other.
11.9	Diagnose problems of suspension systems.
11.1 to 11.12	Repair suspension systems.
9.5	Identify various tupes of steering mechanisms.
	Identify components and describe how they interact with each other.
9.1,9.5,9.9	Diagnose problems and repair steering mechanisms.

TASK NUMBER(S)	TASK
	Describe the various alignment angles.
	Describe and identify problems due to misalignment.
	Perform an alignment to manufacturer's specifications.
	Perform caster, camber, and toe on four types of automotive suspensions.
9.1	Operate a computer wheel balance machine.
9.5, 9.9, 10.14,	Disassemble and reassemble power steering gears and manual steering gears and power brakes.
9.1 to 9.11, 11.1 to 11.12	Diagnose, repair, and align typical steering-suspension system.
	Perform an alignment demonstrating a knowledge of camber, caster, toe in, and tow out on turns and steering axis inclination.
	List and identify each component of the chassis geometry.
	Perform a front end alignment on at least two different types of vehicles.
9.0, 10.0, 11.0	Understand the principles of the suspension system, alignment, steering, brakes, wheel balancing and be able to disassemble, repair, and reassemble those components.

BRAKES

TASK NUMBER(S)	TASK
10.1	Adjusts brake(s).
10.2	Adjusts hand brake linkage.
10.3	Adjust hand brake external band.
10.4	Bleeds brake(s).
10.5	Frees up parking brake cable(s).
10.6	Inspects and replaces brake pads (disc brakes).
10.7	Inspects and turns rotor, if necessary (disc brakes).
10.8	Inspects and turns brake drum(s).
10.9	Inspects, repairs or replaces self adjustor(s).
10.10	Performs operational brake inspection.
10.11	Relines brake shoe(s).
10.12	Replaces disc brake pad(s).
10.13	Repairs or replaces master cylinder.

TASK NUMBER(S)	TASK
10.14	Repairs or replaces hydraulic power brake unit.
10.15	Repairs or replaces hydraulic control valve.
10.17	Repairs brake hose(s) and line(s).
10.11	Replaces brake shoe(s).
10.18	Replaces hand brake linkage.
9.0, 10.0, 11.0	Describe the operating principles of suspension, brakes, and steering systems.
9.1, 10.10, 11.1	Perform diagnosis and inspection of suspension, brakes, and steering systems.
9.3, 9.5to 9.11 10.11 to 10.19 11.2, 11.4, 11.5 11.8 to 11.12	Remove and replace faulty components of suspension, brakes, and steering systems.
9.5, 9.8, 9.9, 9.10, 10.11 to 10.19, 11.2, 11.4, 11.5, 11.8 to 11.12	Overhaul components of suspension, brakes, and steering systems.
10.7, 10.8	Perform brake drum/disc reconditioning procedures.
10.10	Inspect a brake system and identify components in need of service or replacement.
10.1, 10.4, 10.7 10.8	Turn brake drums and/or rotors and bleed and adjust brake systems.

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TASK NUMBER(S)	TASK
10.10	Identify various brake systems.
10.10	Identify components of such brake systems.
10.1, 10.10	Describe how brake systems work.
10.1, 10.19	Repair and recondition brake systems.
10.10	Diagnose problems of brake systems.
10.19	Overhaul wheel cylinders, single and double master cylinders.
10.11, 10.12	Replace brake shoes and/or pads on six types of brake units.
10.7, 10.8	Evaluate and remachine a brake drum and rotor.
10.1, 10.4	Bleed and adjust two types of brake systems.
9.1 to 9.11, 10.1 to 10.19, 11.1 to 11.12	Service and repair brake and chassis assemblies.
10.1 to 10.19	Diagnose, service, and repair a typical hydraulic brake system.
10.4, 10.13, 10.19	Service and repair basic hydraulic systems.
10.1 to 10.19	Disassemble a brake system and reassemble parts, bleeding and adjusting brakes and demonstrating a knowledge of parts and parts condition.

TASK NUMBER(S)	TASK
10.7, 10.8	Demonstrate proper use of brake drum lathe.
10.10	Identify and describe various brake systems.
10.1 to 10.19	Perform repairs on both disc and drum brakes.

AIR CONDITIONING AND HEATING

TASK NUMBER(S)	TASK
12.4	Checks coolant temperature.
12.3	Checks overflow tank and accessories.
12.6	Chemically cleans and flushes cooling system.
12.9	Inspects, adjusts and/or replaces fan.
12.7	Replaces heater hose(s).
12.8	Replaces radiator hose(s).
12.9	Replaces variable-speed fan.
13.1	Inspects and refills system with freon.
13.3	Diagnoses air conditioning malfunction(s).
13.2	Pressure tests, performance tests and leak tests system.
13.4	Repairs or replaces air conditioning compressor.
13.6	Evacuate system.
13.5	Repairs compressor shaft seal(s).

TASK NUMBER(S)	TASK
13.13	Repairs automatic A/C and heater systems vacuum and electrical circuits.
13.5	Replaces compressor seals.
13.7	Replaces condenser in air conditioning unit.
13.10	Replaces air conditioner fan motor.
13.8	Replaces evaporator in air conditioning unit.
13.9	Replaces dryer in air conditioning unit.
13.11	Replaces expansion valve in air conditioning unit.
13.12	Replaces freon control valve diaphragm in air conditioning unit.
13.14	Services air conditioner control cables and switches.
14.1	Diagnoses heating system malfunction(s).
14.2	Inspects and replaces defroster hose.
14.3	Replaces heater control unit(s).
14.4	Removes and repairs or replaces heater core.

TASK NUMBER(S)	TASK
14.5	Services heater control component(s).
13.13	Demonstrate ability to read and use electrical and vacuum diagrams and shop manuals.
13.1 to 13.14	Use safety precautions in servicing electrical and air conditioning systems.
13.2, 13.3, 13.14	Explain the operating principles of the refrigeration and automatic temperature control systems.
13.3	Diagnose electrical and air conditioning problems.
13.13	Demonstrate proper use of electrical test equipment.
13.1 to 13.14	Demonstrate proper use of air conditioning test equipment.
13.4, 13.7 to 13.14	Repair and/or replace electrical and/or air conditioning components.
13.1 to 13.14	Perform evacuation, charging, and leak detection and repair of the air conditioning system.
13.2, 13.3	Identify and describe the major components of a modern automotive air conditioning system.
13.1, 13.2	Discharge, check oil level, evacuate, recharge, and check for leaks in a modern automotive air conditioning system.
13.5	Replace the shaft seal on the most common types of automotive air conditioning compressors.
13.2	Explain the operation of manual and automatic air conditioning systems.

TASK NUMBER(S)	TASK
13.2	Explain the operation of basic air conditioning system refrigerant flow.
13.13	Diagnose and repair manual and automatic air conditioning systems.
7.19	Read and interpret automotive electrical schematics.
7.1,7.16	Diagnose and repair automotive electrical accessory systems.
7.1,7.16	Use accurate and systematic trouble-shooting techniques.
13.1,13.6	Discharge, evacuate, and recharge basic automotive refrigeration system.
13.2	Test automotive refrigeration system flow valves and test and adjust thermostratic switches.
13.5	Replace shaft seals on three types of automotive compressors service the compressor clutch and idler pulley bearings.
12.1 to 12.15, 13.1 to 13.14	Diagnose, service, and repair cooling and refrigeration systems.
13.1 to 13.14	Service a typical automotive air conditioning system.
13.1 to 13.14	Service an automotive air conditioning system, trouble-shoot, repair, and understand the related theory which accompanies the science of the system.

ENGINE PERFORMANCE

TASK NUMBER(S)	TASK
8.19	Repairs or replaces wiring harness for electronic fuel injection system.
8.7	Repairs or services carburetor(s).
8.15	Repairs or services exhaust emission control system.
8.22	Services or repairs turbocharger.
8.16	Services or replaces manifold head control(s).
8.20	Reads vacuum schematic(s).
8.21	Services or replaces units in a vacuum system.
8.7	Describe basic principles of carburetion.
8.7	Trace circuits in selected carburetors.
8.7, 8.9, 8.10 8.11	Disassemble, clean, reassemble, and adjust carburetors to manufacturer's specifications.
8.8	Diagnose carburetor circuit problems.
8.7, 8.10	Recondition selected carburetors with electronic controls to manufacturer's specifications.
	Compare electronic controls to past mechanical methods of control.

TASK NUMBER(S)	TASK
15.0	Be familiar with devices used to control emissions.
15.0	Determine the importance of maintenance and tune-up in the reduction of emission.
15.3	Evaluate normal and abnormal oscilloscope patterns.
15.5, 7.17	Use the engine analyzer for diagnosis and service of driveability complaints.
15.5	Diagnose problems related to high or low HC-CO readings.
7.15	Identify and describe the components of a standard, HEI, Dura Spark, and Chrysler ignition system.
8.7	Identify and describe the carburetor circuits which are common to 80 percent of the carburetors found on domestic cars.
8.11	Perform idle mixture adjustments on HC stable engines using lean drop, propane enrichment, or infra-red procedures.
	Describe the conditions and factors which cause the production of HC, CO, or NOx.
8.3	Test a fuel pump for proper pressure and volume.
15.3	Identify an abnormal ignition pattern on an oscilloscope.
7.17, 15.5	Determine if a cylinder misfire is due to an electrical problem, a mechanical problem, or a lean condition.
7.14, 7.15	Remove and replace a distributor and set to proper base timing specifications.

TASK NUMBER(S)	TASK
7.17	Test the performance of EFE, EGR, air injection, thermal vacuum switch, and heated air systems.
	Describe the operation of a CCC, EFI, or EECIV electronic control system.
8.14, 15.9, 15.10	Perform appropriate diagnostic procedures, as specified in the manufacturer's service manual, on CCC, EFI, or EECIV electronic engine control systems.
8.7, 8.19	Explain the operation of fuel delivery systems, carburetors, and electronic fuel injection systems.
8.2 to 8.5, 8.10, 8.19	Diagnose and repair fuel delivery systems, carburetors, and electronic fuel injection systems.
7.17, 15.1 to 15.11	Operate electronic test equipment accurately in the process of diagnosing mechanical, electrical, and fuel system malfunctions.
15.9 to 15.11	Diagnose and repair computerized engine control systems.
7.17	Tune-up four different types of automotive engines.
7.17	Adjust four different types of automotive engines to given standards using diagnostic and emissions detecting equipment.
7.11 to 7.15	Repair a breaker point ignition system.
7.17, 15.1 to 15.5	Use an oscilloscope to identify ignition problems.
7.18	Tune-up four varieties of automotive engines using convention hand-held equipment.
8.10	Disassemble and reassemble a one and two venturi carburetor and adjust carburetor to factory specifications.

TASK NUMBER(S)	TASK
7.1 to 7.18	Diagnose, service, and repair ignition, charging, and starting systems.
15.1 to 15.5	Perform required task utilizing dynamometers, oscilloscopes, and sophisticated tune-up equipment.
8.9, 8.12	Diagnose problems with and remove and replace fuel pumps and carburetors.
8.7	Rebuild a modern carburetor using accepted methods.
7.11 to 7.19	Test and service gasoline ignition systems.
7.14, 7.15, 7.18	Adjust timing, dwell, reluctor air gap and replace and test all ignition parts.
8.7	Name the seven circuits of a carburetor and explain how they work.
8.2	Explain and identify the different parts of a complete fuel system.
8.6, 8.7	Diagnose and repair the common problems that are encountered in the carburetor.
8.7 to 8.10	Disassemble, inspect, repair, and install at least six different types of carburetors.
7.17, 15.1 to 15.5	Analyze and diagnose engine problems through the use of various diagnostic equipment.
7.17, 15.1 to 15.8	Perform a complete auto tune-up.
7.17, 15.1 to 15.11	Understand the diagnosis process in trouble-shooting the ignition, carburetion, and emission control components of an automotive engine; be able to operate an oscilloscope in conjunction with a chassis dynamometer. Totally repair those components as part of a major tune-up.

TASK NUMBER(S)	TASK
7.17	Performs cylinder balance test.
4.2	Performs cylinder leakage test.
4.31	Replaces muffler.
4.32	Replaces tail pipe assemblies.
4.29	Repairs or services crankcase ventilation system.
4.1	Runs compression test.
7.16, 7.17, 15.1 to 15.11	Analyzes or adjusts engine performance using engine analyzer.
7.13, 7.16	Analyzes or adjusts engine performance using ohmmeter and volmeter.
7.12	Cleans, gaps and tests spark plugs.
7.13	Inspects secondary circuit leads, plug wires, distributor cap and/or rotor.
7.18	Inspects solid state ignition and/or electronic engine computer(s).
7.11	Inspects and repairs ignition switch, resistor, wiring, coil, points, and condenser of the primary circuit.
7.4	Measures resistance in plug wires.

TASK NUMBER(S)	TASK
7.15	Repairs distributor.
7.14	Sets ignition timing.
8.11	Adjusts carburetor.
8.8	Analyzes for moisture or foreign particle level in fuel system.
7.17,15.5	Analyzes fuel injection problems by means of electrical diagnostic equipment.
8.7	Cleans carburetor.
8.5	Cleans or replaces fuel filter unit(s).
8.6	Inspects, cleans and adjusts choke unit (automatic and manual).
8.1	Inspects, services or replaces carburetor air cleaner.
8.13	Inspects, services or replaces fuel tank, cap and sending unit.
8.9	Installs carburetor.
8.3	Measures fuel flow and pressure.
8.14	Performs operational inspections of exhaust emission control system.

TASK NUMBER(S)	TASK
8.2	Performs operational inspections of fuel system.
8.12	Removes, services or replaces fuel pump.
8.19	Repairs or replaces electrical fuel injection computer.
8.17, 8.18	Repairs or replaces fuel injector.
8.4	Repairs or replaces fuel line(s) and hose(s).

The Employability Skills Charts, which follow, are used to show a crosswalk between the charts and the curriculum guide. Numbers next to **RELATED BASIC SKILLS, JOB SKILLS** and **RESPONSIBILITY SKILLS** are the competency or task numbers in the curriculum. To determine which employability skill may be incorporated into teaching, compare the skill with the competency or task number shown.

Detailer

Related Basic Skills

MATHEMATICS

13 Interprets manuals, charts, graphs, and schematics.

SCIENCE

10 Identifies oxidation as the cause of rust.

7 Demonstrates knowledge of chemical reactions when handling battery acid, hazardous chemicals, and other corrosive agents.

Demonstrates fire prevention skills.

7 Demonstrates an understanding of direct current electrical systems.

6 Identifies the effects of expansion and contraction in metal and fluids.

COMMUNICATIVE ARTS

2,3 Uses the appropriate vocabulary of the automobile industry.

3 Writes concise information.

Detailer

Job Skills

1,2 Inspects vehicles inside and out for flaws and working condition of lights, windshield wipers, horn, mirrors, tires.

1,2,3 Checks correct operation of optional equipment.

1,2,3 Requests supplies from the parts department.

1,2,3 Installs factory parts as required for final assembly.

1,2,3 Services vehicles with gas, oil, and grease, and checks all other fluid levels.

1,2,3 Changes, repairs, rotates, and balances tires.

1,2,3 Steam cleans engines, washes and polishes vehicles, and details interiors.

1,2,3 Performs road tests and checks for correct operation of engine, transmission, brakes, steering.

1,2,3 Checks for safe overall operation.

1,2,3 Prepares inspection and work completion reports.

1 Demonstrates correct usage of solvents, cleaning agents, sealers, and polish.

Detailer

Responsibility Skills

* Works without close supervision; takes initiative.

* Works within the organizational structure.

* Works well with fellow employees.

* Respects authority and carries out assignments willingly.

* Accepts responsibility for own actions.

* Uses time management skills.

* Presents an appropriate personal appearance.

* Demonstrates flexibility in work.

* Respects the property of others.

* Exhibits positive health and safety habits in working with people, equipment, and lifting objects.

* Keeps up-to-date with new information related to the job.

* Possesses valid driver's license and demonstrates acceptable driving skills.

(* Responsibility Skills are stressed in all competency areas)

Mechanic's Helper

Related Basic Skills

MATHEMATICS

13 Interprets manuals, charts, graphs, and schematics.

SCIENCE

10 Identifies oxidation as the cause of rust.

7 Demonstrates knowledge of chemical reactions when handling battery acid, hazardous chemicals, and other corrosive agents.

Demonstrates fire prevention skills.

7 Demonstrates an understanding of direct current electrical system.

6 Identifies the effects of expansion and contraction in metal and fluids.

COMMUNICATIVE ARTS

2,3 Uses the appropriate vocabulary of the automobile industry.

Mechanic's Helper
Job Skills

1,2 Finds the causes of vehicle failures and makes routine inspections.

2,3 Performs regular scheduled work and completes service records.

3,4 Under supervision performs engine overhaul procedures.

5,6 Maintains and repairs the drive train.

7 Tests and replaces faulty electrical system parts.

12,14 Maintains, repairs, or replaces cooling system parts.

10,11 Performs routine repairs and replacement of parts in the steering, brake, and suspension system.

13 Checks vehicle air conditioning for leaks, replaces worn parts, and charges system.

12,13 Repairs or replaces faulty heaters and control switches, levers, and cables.

Uses test equipment.

Mechanic's Helper

Responsibility Skills

- * Works without close supervision; takes initiative.
- * Works within the organizational structure
- * Works well with fellow employees.
- * Respects authority and carries out assignments willingly.
- * Accepts responsibility for own actions.
- * Uses good time management skills.
- * Presents an appropriate personal appearance
- * Demonstrates flexibility in work.
- * Respects the property of others.
- * Exhibits positive health and safety habits in working with people, equipment, and lifting objects.
- * Keeps up-to-date with new information related to the job.
- * Exhibits cleanliness of tools and work space.
- * Possesses valid driver's license and demonstrates acceptable driving skills.

(* Responsibility Skills are stressed in all competency areas)

Automotive Mechanic Specialists
Related Basic Skills

MATHEMATICS

7.3 Calculates tolerances and ratios using various measurement systems.

SCIENCE

6 Demonstrates an understanding of the principles of hydraulics, electronics, and pneumatics as appropriate for specialty.

5,6 Demonstrates an understanding of the effects of stress, clearance, and tolerance.

8 Demonstrates an understanding of the properties of certain gases and chemicals.

COMMUNICATIVE ARTS

13 Reads charts, manuals, schematics, tables, and graphs.

7,15 Interprets the results of electronic sensors and computerized controls.

Automotive Mechanic Specialists
Job Skills

Climate Control Specialist

13	Inspects and repairs or replaces air conditioning systems.
14	Inspects and repairs or replaces heating system.
12,13, 14	Diagnoses electronic computer problems in climate control system.
13	Checks system for leaks and adds freon.
13	Replaces compressor in air conditioning system.
13	Replaces electronic resistors in climate control system.

Engine Overhaul Specialist

1-5,12	Inspects and diagnoses engine problems.
1-5,12	Grinds valves.
1-5,12	Installs new rings.
1-5,12	Installs oil pumps.
1-5,12	Replaces timing gears and chain.
1-5,12	Rebuilds manual transmission.
1-5,12	Repairs or replaces differentials.
1-5,12	Replaces pilot bearings.
1-5,12	Repairs or replaces engines.
1-5,12	Replaces engine mounts.
1-5,12	Replaces radiators.
1-5,12	Inspects and flushes cooling system.
1-5,12	Analyzes and repairs cooling system problems.

Automotive Mechanic Specialists
Responsibility Skills

* Works as a member of a team to solve problems.

* Respects the opinions of other people on the team.

* Utilizes team members as resource persons.

* Takes pride in workmanship and development of safe working habits.

* Complies with shop standards, company policy, and government regulations.

* Maintains the flexibility and knowledge necessary to switch from one job task to another.

* Deals effectively and appropriately with frustration, stress, and tension.

* Accepts responsibility for own actions.

* Establishes short-term and long-term goals.

* Communicates effectively and appropriately with supervisor or the person who maintains contact with the customer.

* Demonstrates good industrial safety habits.

(* Responsibility Skills are stressed in all competency areas)

Automotive Mechanic Specialists

Related Basic Skills

MATHEMATICS

7.3 Calculates tolerances and ratios using various measurement systems.

SCIENCE

6 Demonstrates an understanding of the principles of hydraulics (works by fluid), electronics, and pneumatics (works by air) as appropriate for specialty.

5,6 Demonstrates an understanding of the physical effects of stress, clearance, and tolerance.

8 Demonstrates an understanding of the properties of certain gases and chemicals.

COMMUNICATIVE ARTS

13 Reads charts, manuals, schematics, tables, and graphs.

7,15 Interprets the results of electronic sensors and computerized controls.

Automotive Mechanic Specialists
Job Skills

Brake Specialist

1-3,10 Inspects and turns brake drums.

1-3,10 Inspects and turns rotors.

1-3,10 Replaces brake pads.

1-3,10 Repairs or replaces brake cylinders.

1-3,10 Repairs brake hoses.

1-3,10 Replaces brake shoes.

1-3,10 Bleeds brake system.

1-3,10 Adjusts brakes.

Front End Alignment Specialist

1-3,11 Inspects and replaces front wheel bearings.

1-3,11 Inspects and repairs front suspension system.

1-3,11 Inspects steering.

1-3,11 Inspects and replaces steering damper.

1-3,11 Replaces shock absorbers and mountings.

1-3,11 Adjusts or replaces torsion and trunnion bars.

1-3,11 Balances wheels and tires.

1-3,11 Repairs or replaces power steering pump.

1-3,11 Replaces pivot points on steering linkage.

1-3,11 Rebuilds power steering cylinder.

1-3,11 Lubricates ball joints.

Automotive Mechanic Specialists

Responsibility Skills

* Works as a member of a team to solve problems.

* Respects the opinions of other people on the team.

* Utilizes team members as resource persons.

* Takes pride in workmanship and development of safe working habits.

* Complies with shop standards, company policy, and government regulations.

* Maintains the flexibility and knowledge necessary to switch from one job task to another.

* Deals effectively and appropriately with frustration, stress, and tension.

* Accepts responsibility for own actions.

* Establishes short-term and long-term goals.

* Communicates effectively and appropriately with supervisor or the person who maintains contact with the customer.

(* Responsibility Skills are stressed in all competency areas)

Automotive Mechanic Specialists
Related Basic Skills

MATHEMATICS

7.3 Calculates tolerances and ratios using various measurement systems.

SCIENCE

6 Demonstrates an understanding of the principles of hydraulics, electronics, and pneumatics as appropriate for specialty.

5,6 Demonstrates an understanding of the effects of stress, clearance, and tolerance.

8 Demonstrates an understanding of the properties of certain gases and chemicals.

COMMUNICATIVE ARTS

13 Reads charts, manuals, schematics, tables, and graphs.

7,15 Interprets the results of electronic sensors and computerized controls.

Automotive Mechanic Specialists
Job Skills

Tune-Up Specialist

- Reads vacuum schematic.
- Reads electrical schematic.
- Analyzes fuel injection problems by means of electrical diagnostic equipment.
- Inspects and replaces solid state ignition components.
- Inspects electronic computer using diagnostic equipment.
- Measures resistance in plug wires using ohmmeter and makes replacements.
- Cleans and tests spark plugs.
- Adjusts carburetor.
- Repairs or replaces electrical fuel injection computer.

(* Tune-Up Specialist skills are stressed in competencies 1-3,7,8,15)

Transmission Specialist

- Adjusts shift linkage.
- Cleans and visually inspects transmission.
- Removes and installs transmission.
- Services filter and checks transmission cooling system.
- Makes internal repairs and adjustment on automatic transmission.
- Removes and replaces transmission oil.

(* Transmission Specialist skills are stressed in competencies 1-3,5,6)

Automotive Mechanic Specialists

Responsibility Skills

* Works as a member of a team to solve problems.

* Respects the opinions of other people on the team.

* Utilizes team members as resource persons.

* Takes pride in workmanship and development of safe working habits.

* Complies with shop standards, company policy, and government regulations.

* Maintains the flexibility and knowledge necessary to switch from one job task to another.

* Deals effectively and appropriately with frustration, stress, and tension.

* Accepts responsibility for own actions.

* Establishes short-term and long-term goals.

* Communicates effectively and appropriately with supervisor or the person who maintains contact with the customer.

* Demonstrates good industrial safety habits.

(* Responsibility Skills are stressed in all competency areas)

Master Mechanic

Related Basic Skills

MATHEMATICS

Makes estimates based on manpower, time, and costs.

Demonstrates knowledge of bookkeeping.

Demonstrates knowledge of scheduling.

COMMUNICATIVE ARTS

Effectively communicates, both verbally and in writing, with employees, customers, and management.

Analyzes, identifies, and corrects situations using critical thinking skills.

Uses technical vocabulary appropriately.

Demonstrates the ability to generate and keep effective records.

Master Mechanic

Job Skills

1-15+ Analyzes and identifies the probable cause of all mechanical, electrical, hydraulic (works by fluid), pneumatic (works by air), solid state electrical system, and fluid failures.

1-15+ Performs inspections and identifies repairs needed on all areas of the vehicle.

1-15+ Advises and supervises specialists, mechanics, helpers, and detailers.

1-15+ Provides the daily work control, makes assignments, and keeps records of all progress made on the jobs.

1-15+ Computes average rate of pay for mechanics as well as actual cost of vehicle repairs.

1-15+ Performs supervisory duties.

1-15+ Assesses and arranges training programs.

1-15+ Sells products and services.

1-15+ Designs management techniques.

1-15+ Demonstrates knowledge of business procedures.

1-15+ Demonstrates basic merchandising and advertising procedures.

Master Mechanic
Responsibility Skills

* Uses time management skills.

* Provides opportunities for employee growth and development.

* Accepts supervision from superiors and delegates responsibility to employees.

* Displays ethical and professional behavior.

* Demonstrates leadership skills.

* Displays management skills.

* Performs public relations and promotional activities.

* Handles pressure and manages stress.

(* Responsibility Skills are stressed in all competency areas)

1.0 COMPETENCY/SKILL: Lubricates and maintains vehicles.

1.1 TASK: Inspects and cleans automobile interiors.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), cleaning products and equipment,

EVALUATION: clean the interior including carpets, upholstery and windows.

STANDARD: Vehicle should be restored to a clean, saleable state.

STUDENT LEARNING EXPERIENCES:

1. Discuss types of cleaning products.
2. Discuss different cleaning methods.
3. Demonstrate cleaning of auto interior.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain types of cleaning products.
2. Explain different cleaning methods/techniques.
3. Demonstrate cleaning of auto interiors.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Wet and dry shop vacuum, air hose and blow nozzle, scrub brush and wash bucket, cleaning rags, upholstery shampoo, window cleaner, and spotting solution.

RESOURCES:

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.2 **TASK:** Changes oil and filter(s).

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle(s), tools and equipment, oil and oil filter,
EVALUATION:	lift vehicle, drain oil, remove and replace oil filter, lower vehicle, and refill with proper type and amount of engine oil.
STANDARD:	There should be no leaks at the oil filter or drain plug.

STUDENT LEARNING EXPERIENCES:

1. Discuss types of engine oil.
2. Discuss types of oil filters.
3. Read and interpret lubrication guides.
4. Demonstrate oil and filter change.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain types of engine oil and filters.
2. Explain reasons for oil change intervals.
3. Demonstrate use of lubrication guides.
4. Demonstrate oil and filter change.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, 5 qt. drain pan, funnel, oil filter, floor jack and jack stands, oil filter wrench, oil can spout, fender covers, 5 qts. motor oil, chassis hoist (optional).

RESOURCES:

Remling, John. BASICS. Standard oils lubrication guide. Chapter 3.

AUDIOVISUAL MATERIAL

"Some answers about engine oil". Cadillac.

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.3 **TASK:** Lubricates vehicle and equipment.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools and equipment, lubrication guide, and proper lubricants,

EVALUATION: lubricate all under car chassis fittings, including universal joints, and check adjustment on the transmission gear lube and differential lube. All under hood lube levels will be checked.

STANDARD: All lube levels should be correct, and all under car lube points should be lubricated as inspected by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss type of lubricants and their applications.
2. Interpret lubrication guides.
3. Demonstrate proper lubrication of vehicles.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain types of lubricants and their applications.
2. Explain use of lubrication guides.
3. Demonstrate proper lubrication of vehicle(s).

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, hand operated grease gun, fender covers, floor jacks and jack stands, rags, and assorted lubricants.

RESOURCES:

Remling, John. BASICS, Standard oils lubrication guide. Chapter 3.

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.4 **TASK:** Performs road service.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, and equipment,

EVALUATION: jack a vehicle with a bumper jack and change a tire and "jump start" a vehicle with a low battery.

STANDARD: Cannot be taught at secondary level.

STUDENT LEARNING EXPERIENCES

1. Discuss safe procedures for changing flat tire.
2. Discuss safe methods of "jump starting" a vehicle.
3. Demonstrate both of above mentioned.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate safe procedure for changing flat tire on vehicle.
2. Demonstrate safe procedure for "jump starting" a vehicle.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Bumper jack, floor jack (optional), four way tire iron, lug wrench, spare tire, battery jumper cables, and tire chalk.

RESOURCES:

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.5 **TASK:** Picks up stalled vehicle/cannot be taught at secondary level.

PERFORMANCE OBJECTIVE:

Reference - Competency n/a

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.6 **TASK:** Services vehicle with fuel or oil.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle and equipment,

EVALUATION: fill vehicle with gas and check oil level and adjust as needed.

STANDARD: Levels will be filled correctly.

STUDENT LEARNING EXPERIENCES:

1. Discuss leaded and unleaded fuel.
2. Demonstrate proper use of a fuel pump.
3. Discuss methods of checking oil levels.
4. Demonstrate refilling of engine oil.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain different types of fuels and oils.
2. Demonstrate use of fuel pump.
3. Demonstrate refilling vehicle with oil.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fuel pump, oil spout, and rag.

RESOURCES:

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.7 **TASK:** Winterizes vehicle(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools, materials, and manuals,

EVALUATION: inspect the condition of the anti-freeze in the cooling system, examine the engine oil, and inspect the battery condition.

STANDARD: All items must be adjusted to manufacturer's written climate specifications.

STUDENT LEARNING EXPERIENCES:

1. Discuss how to determine state of anti-freeze.
2. Demonstrate battery terminal service.
3. Discuss the reasons for using different viscosities of engine oil.
4. Demonstrate changing of oil.
5. Define winterizing.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how to determine state of anti-freeze.
2. Explain seasonal changed in engine oil viscosity.
3. Explain importance in clean battery terminals.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Cooling system hydrometer, anti-freeze, winter weight oil, basic hand tool set, manufacturer's service manuals.
2. funnel, fender cover, oil filter, and battery service tools.

RESOURCES:

Manufacturer's service manuals.

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.8 **TASK:** Installs minor accessories such as radios and mirrors.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools, equipment and accessories,

EVALUATION: prepare the vehicle and install the accessories as per the manufacturer's recommended procedures.

STANDARD: All installed accessories should be cosmetically and functionally operational.

STUDENT LEARNING EXPERIENCES:

1. Interpret manufacturer's and after market installation guides.
2. Demonstrate installation of small accessories.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain after market installation guides.
2. Demonstrate preparation of vehicle for installation of accessories.
3. Demonstrate what is and is not cosmetically correct.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, 3/8" drill, any small accessories, assorted hole saws, and assorted adhesives.

RESOURCES:

Manufacturer's and after installation guide.

1.9 **TASK:** Performs vehicle pre-delivery inspection.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, forms, and supplies,

EVALUATION: inspect the vehicle as per to manufacturers checklist and make note of any and all items needimg service.

STANDARD: Student checklist should match items checked by instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss reasons for pre-delivery inspection.
2. Define acceptable and non-acceptable items.
3. Perform several pre-delivery inspections.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain reasoning for pre-delivery inspection.
2. Outline what are acceptable and non-acceptable conditions of items being inspected.
3. Demonstrate a pre-delivery inspection.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Clipboard, pre-delivery inspection checklist, pen or pencil, tire pressure gauge, and rags.

RESOURCES:

Manufacturer's pre-delivery inspection guides.

1.0 COMPETENCY/SKILL: Lubricates and maintains vehicles.

1.10 TASK: Remove and replace alternator/generator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s) with an alternator/generator, tools, service manuals, and known good alternator/generator,

EVALUATION: remove old alternator/generator and replace with a known good alternator/generator.

STANDARD: Alternator/generator is installed correctly, tightened in place and has specified belt tension.

STUDENT LEARNING EXPERIENCES:

1. Identify alternator/generator.
2. Interpret manufacturer's specifications for fan belt tension.
3. Demonstrate replacement of alternator/generator.
4. Discuss reasons for disconnecting battery terminals.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain different types of alternators and generators.
2. Explain reasons for proper tensioning of belts.
3. Explain reasons for removal of battery negative lead before replacing alternator/generator.
4. Demonstrate replacement of alternator/generator.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, small pry bar, fender covers, and belt tension gauge.

RESOURCES:

Remling, John. BASICS. Standard oil lubrication guide. Chapter 15.

1.0 **COMPETENCY/SKILL:** Lubricates and maintains vehicles.

1.11 **TASK:** Inspects, adjusts or replaces fan belt(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools and specifications,

EVALUATION: inspect, and if needed, adjust or replace and adjust belts.

STANDARD: Belts are correctly installed, tensioned, and vehicle is in safe running order.

STUDENT LEARNING EXPERIENCES:

1. Discuss different types of V-belts.
2. Discuss reasons for belt failure.
3. Demonstrate methods of belt inspection.
4. Demonstrate replacement/adjustment of a fan belt.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain different types of V-belt construction and applications.
2. Explain reasons for belt failures.
3. Explain methods of belt inspection.
4. Demonstrate use of belt tension gauge.
5. Demonstrate replacement/adjustment of a fan belt.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, new fan belt(s), small pry bar, and fan belt tension gauge.

RESOURCES:

Remling, John. BASICS. Standard oil lubrication guide. Chapter 1.

Manufacturer's specification manuals

1.11.1 **TASK:** Identifies and adjusts fan belts.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile, service manuals, tools, and equipment,

EVALUATION: inspect, replace, and adjust the fan belt according to manufacturer's specifications.

STANDARD: Fan belt must be properly installed and adjusted according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Use a belt tension gauge.
2. Identify various types of belts.
3. Identify belt conditions that would necessitate replacement.
4. State general rule for tightness when no tension gauge is used.
5. Explain reason for replacing both belts in matched sets.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss drive belt hazards and safety.
2. Cut sections from discarded belts to illustrate construction.
3. Use sections of discarded belts to illustrate types of defects.
4. Describe the difference in construction between air conditioner drive belts and water pump drive belts.
5. Explain reason for replacing both belts in parallel belt applications.
6. Demonstrate adjusting belt tension, using tension gauge and "rule of thumb" methods.
7. Have students adjust belt tension after removal and replacement.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, drive belt tension gauge.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 20.8. 1986.

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.1 **TASK:** Prepares inspection report(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, inspection report, and instructions,

EVALUATION: inspect vehicle and note all malfunctions on inspection report.

STANDARD: Inspection report will be complete with information and correct spelling.

STUDENT LEARNING EXPERIENCES:

1. Examine different types of vehicle inspection reports.
2. Discuss vehicle inspection techniques.
3. Demonstrate vehicle inspection report completion.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss different types of vehicle inspection reports.
2. Demonstrate vehicle inspection and proper report completion.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Pen or pencil, various inspection reports, and vehicles for inspection.

RESOURCES:

State inspection report form.

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.2 **TASK:** Perofrms inspections of vehicle conditions.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.3 **TASK:** Performs inspection of vehicle lighting system(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 7.27

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.4 **TASK:** Inspects vehicle mirrors.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.5 **TASK:** Inspects tires and wheels.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.5

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.6 **TASK:** Inspects and tests windshield-wiper motor, blades and arms.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.7 **TASK:** Performs vehicle pre-delivery inspection.

PERFORMANCE OBJECTIVE:

Reference - Competency 1.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.8 **TASK:** Inspects maintenance procedure(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 2.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.9 **TASK:** Direct quality checks of vehicle after maintenance.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s) maintenance service record(s) or report(s), maintenance guide(s), and quality control check list(s),

EVALUATION: evaluate vehicle maintenance performed and compare to recommended service procedures.

STANDARD: Report should match instructor's evaluation with all discrepencies noted on the quality control report.

STUDENT LEARNING EXPERIENCES

1. Discuss reasons for pre-delivery inspection.

2. Define acceptable and non-acceptable items.

3. Demonstrate inspection techniques.

SUGGESTED INSTRUCTIONAL TECHNIQUES

1. Explain reasoning for pre-delivery inspection.

2. Outline what are acceptable and non-acceptable conditions of items being inspected.

3. Demonstrate a pre-delivery inspection.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Manufacturer's guide for vehicle maintenance procedures, vehicle owner's manual, after market guide(s) for vehicle maintenance, quality control check list for vehicle maintenance, and pen and clipboard.

RESOURCES:

Manufacturer's guide for vehicle maintenance procedures.

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.10 **TASK:** Analyzes maintenance reports on vehicles.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.11 **TASK:** Estimates cost of vehicle repair(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle estimation form with a suggested repair list,

EVALUATION: research flat rate for a given vehicle repair, parts list(s), and costs and estimate cost of repair using flat rate guide and parts catalogs.

STANDARD: All estimations shall be complete and mathematically correct.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate ability to read flat rate guides.
2. Perform calculator functions.
3. Locate aprts using catalogs and price sheets.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain the indexing of flat rate manuals.
2. Demonstrate the use of parts catalogs and price sheets.
3. Demonstrate use of calculator.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Flat rate manuals, parts catalogs and price sheets, calculator, estimationforms, pen or pencil.

RESOURCES:

Chilton Flat Rate Manual

2.0 **COMPETENCY/SKILL:** Demonstrates knowledge of vehicle evaluation and inspection.

2.12 **TASK:** Analyzes cause of vehicle malfunction.

PERFORMANCE OBJECTIVE:

Reference - Competency 15.0

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.1 **TASK:** Initiates and completes work orders.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given all pertinent information, work order forms, and directions,

EVALUATION: initiate work order form(s), add all parts and labor time involved, complete the work order and record and file the work order invoice.

STANDARD: Completed forms shall have no incorrect spellings, and have all information required by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss different types of work order forms.
2. Demonstrate use of flat rate guide.
3. Compile all information necessary to complete work order form(s).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain types of work order froms to be used.
2. Demonstrate use of flat rate manual.
3. Demonstrate proper procedure for completion of work order forms.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assorted work order forms, pen or pencil, clipboard, and flat rate guide(s).

RESOURCES:

3.2 **TASK:** Initiates request for part(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given forms and instructions,

EVALUATION: initiate parts request, check on status of procurement, document receipt of parts, enter all charges on work order forms, and complete billing invoices.

STANDARD: All forms must be complete and correct in content as checked by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Examine different types of parts procurement forms.
2. Demonstrate proper technique for parts procurement.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain the proper use of different types of parts procurement forms.
2. Explain in detail how to follow-up on parts requests and proper procedures for receipt, documentation, and billing of parts.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Part procurement forms, purchase orders/requisitions, work order forms, pen or pencil.

RESOURCES:

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.3 **TASK:** Prepares report(s) for vehicle defect(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.4 **TASK:** Inspects lubrication and service guide.

PERFORMANCE OBJECTIVE:

Reference - Competency 2.8

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.5 **TASK:** Follows up on requisition(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 3.2

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.6 **TASK:** Completes requests for procurement of parts.

PERFORMANCE OBJECTIVE:

Reference - Competency 3.2

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.7 **TASK:** Enters work performed on work order(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 3.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.8 **TASK:** Determines acutal cost of vehicle repair(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 2.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.9 **TASK:** Records and processes records on vehicles being serviced and repaired.

PERFORMANCE OBJECTIVE:

Reference - Competency 3.1 and 3.2

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.10 **TASK:** Completes forms when servicing vehicle(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.11 **TASK:** Completes labor time cards.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given forms, information and instruction,

EVALUATION: research in flat rate labor guide all service performed on a vehicle and document labor times on labor time cards.

STANDARD: All recorded labor times shall be correct as listed on labor time cards.

STUDENT LEARNING EXPERIENCES:

1. Interpret time labor guides.
2. Demonstrate ability to restate labor figures on labor time cards.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain and demonstrate use of flat rate guide.
2. Explain procedure for entering labor time on time card.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Labor cards, flat rate guides, pen or pencil, and work order forms.

RESOURCES:

Chilton flat rate manuals.

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.12 **TASK:** Completes unsatisfactory reports(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 3.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

3.0 **COMPETENCY/SKILL:** Directs maintenance and control functions.

3.13 **TASK:** Spot checks service orders.

PERFORMANCE OBJECTIVE:

Reference - Competency 3.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.0 COMPETENCY/SKILL: Engine overhaul.

4.1 TASK: Performs cylinder compression test.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an engine at normal operating temperature, tools, gauges, and service manual,

EVALUATION: perform a cylinder compression test.

STANDARD: Compression readings obtained must be within + or - 10 psi of those obtained by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Explain the theory of operation for a four-stroke cycle engine.

   Define:
   - compression
   - compression ratio
   - TDC
   - BDC
   - displacement

2. Explain the construction and operation of a compression gauge.

3. Demonstrate the procedures for a compression check.

4. Explain the difference between wet and dry compression checks.

5. Explain how to interpret the readings by a compression test.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use filmstrips to illustrate operation of four-stroke cycle engine.
2. Discuss meaning of TDC, BDC, compression ratio, compression, and displacment.
3. Discuss gauge construction and demonstrate use.
4. Demonstrate wet and dry tests and discuss evaluation of readings obtained.
5. Have students make wet and dry tests.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender cover, spark plug socket and drive, compression tester, oil spurt can, jumper wire, remote starter switch.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Paragraph 4.2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 23. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 15.11. 1986.

4.0 **COMPETENCY/SKILL:** Engine overhaul.

4.2 **TASK:** Performs cylinder leakage test.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an engine at normal operating temperature, tools, equipment, and instruction manual,

EVALUATION: perform a cylinder leakage test.

STANDARD: Readings must be within + or - ten percent of the reading obtained by the instructor and results must be interpreted with no errors.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the method of determining top dead center (TDC) on engine.
2. Calibrate leakage tester.
3. Interpret readings indicating defective intake valve, exhaust valve, head gasket, or piston rings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss results of typical malfunctins such as burned valves, blown head gaskets, and worn piston rings.
2. Demonstrate calibration of leakage tester.
3. Demonstrate procedure for determining TDC on compression stroke and procedure for holding the engine from turning.
4. Demonstrate cylinder leakage testing with and without engine analyzer.
5. Have students perform a cylinder leakage test.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Engine analyzer and air supply, hose with spark plug hole adapter.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Paragraph 4.4. 1974.

Manufacturer's instructions for engine analyzer.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 15.12. 1986.

4.3 **TASK:** Steam clean engine.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle and a steam cleaner,

EVALUATION: steam clean the engine surface under the instructor's supervision.

STANDARD: All heavy deposits of dirt and grease must be dissolved and washed away, the ignition parts must be free of moisture, and the engine operable.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the operation of a steam cleaner.
2. Demonstrate how to protect the internal carburetor and the electrical components from moisture.
3. Demonstrate procedures for starting the engine when ignition system has been disabled due to moisture.
4. Calculate boiling point of water when given pressure in psi.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss relationship between water temperature and water pressure.
2. Discuss safety considerations for personnel involved in steam cleaning the engine.
3. Demonstrate operation of steam cleaner.
4. Demonstrate procedure for starting a "drowned" engine.
5. Have students steam clean and start an engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender covers, and steam cleaner.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Paragraph 5.14.
Manufacturer's manual for steam cleaner. 1974.

4.0 **COMPETENCY/SKILL:** Engine overhaul.

4.4 **TASK:** Removes and replaces engine.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile requiring engine removal, a hoist, service manual, hand tools and equipment,

EVALUATION: remove and replace an engine following manufacturer's procedures.

STANDARD: Engine must be removed and replaced without incurring any damage to surrounding parts, safety practices must be observed, and installation must meet manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify and properly remove and replace all parts attached to engine.
2. Use a lift fixture.
3. Determine accessories to be removed and procedure for removal/replacement.
4. Mark hood to assure alignment on replacement.
5. Observe safety precautions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on engine removal and replacement listed under Selected Audiovisual Materials.
2. Discuss removal of accessories to preclude damage.
3. Discuss personal and job safety precautions to be observed.
4. Demonstrate marking of hood to assure realignment and illustrate proper lifting procedures.
5. Have students remove and replace an engine in conjunction with an engine overhaul.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Engine sling or chain, vehicle lift, drain pans, basic hand tool set, fender covers, chain hoist or equivalent, pry bars and floor jack.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Unit 6. 1974.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 12. 1982.

AUDIOVISUAL MATERIAL

"Engine Removal." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacento, CA. 92383.

"Engine Removal and Replacement." Gould, Inc., Educational Systems Division, 4423 Arden Dr., El Monte, CA. 91731.

"Jacks, Hoists and Crane Safety." ABRAXAS Films, P.O. Box 186, Capitola, CA. 95010.

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4.0 **COMPETENCY/SKILL:** Engine overhaul.

4.5 **TASK:** Disassembles, cleans, and inspects engine.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a used engine, tools, equipment, and service manuals,

EVALUATION: disassemble engine, clean and inpsect each component and identify all components needing maintenance and repair to the instructor.

STANDARD: Each part must meet industry standards for cleanliness and all components needing maintenance and repair must be identified to the instructor.

STUDENT LEARNING EXPERIENCES:

1. Use parts cleaner.
2. Identify proper safety prebAutimns ghe. using solvents.
3. Remove and clean components.
4. Define or explain:

   cylinder taper and out-of-round
   journal taper and out-of-round
   bearing crush and spread
   moving parts

5. State the general specification for:

   maximum permissible cylinder taper and out-of-round before reboring.
   maximum permissible main bearing jounal out-of-round
   maximum permissible connecting rod bearing out-of-round
   maximum permissible connecting rod bearing taper
   maximum and minimum permissible main bearing clearance
   maximum and minimum permissible connecting rod bearing clearance
   maximum permissible timing chain slack
   maximum permissible timing gear clearance
   maximum permissible cam lobe wear
   maximum permissible piston ring groove (ring-to-land) wear
   maximum permissible wrist pin clearance
   maximum permissible oil pump clearance

6. Demonstrate procedure for:

    ridge reaming
    piston removal and cleaning
    camshaft bearing removal
    crankshaft removal and cleaning
    oil pump disassembly and inspection

7. State what metals should not be cleaned in an alkaline solution.

8. Demonstrate the use of:

    plastigauge
    ridge reamer
    cylinder gauge
    outside micrometer
    inside micrometer
    piston groove cleaner
    pullers

9. Name the parts that must be replaced in the same location from which they were removed.

10. Explain the reason for marking bearing caps and explain the consequences of switching them.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on engine disassembly and inspection listed under Selected Audiovisual Materials.

2. List clearances and tolerances on engine block parts and have students give general specifications.

3. Discuss and demonstrate cleaning and inspection procedures and precautions.

4. Have students completely disassemble, clean, and inspect an engine.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, air blow guns, work bench.
2. Buffing and wire wheel, cam bearing installer, high pressure steam or combination cleaner, connecting rod aligner.
3. Cylinder dial indicator gauge, cylinder deglazer, assorted electric drills, engine stand, flywheel turner, gear and bearing pullers.
4. Hydraulic valve lifter tools, assorted micrometers, inspection mirrors, oil drain pans, assorted oil filter wrenches, piston ring groove cleaner, piston ring remover and installer.
5. Ridge reamer, straight edge, air impact wrenches, socket, sending unit remove and replace telescoping (snap) gauges

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Unit 6. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Part 6. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 12-16. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 15. 1986.

AUDIOVISUAL MATERIAL

"Auto Engine Measuring Procedures." Gould, Inc., Education Systems Div., 4423 Arden Drive, El Monte, CA. 91731.

"Crankshaft Inspection and Installation." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

"Cylinder Ridge and Piston Removal." Prentice Hall Media.

"Engine Block Inspection and Preparation." Prentice Hall Media.

"Engine Disassembly." Mt. Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"Engine Inspection and Measurement." Mt. San Jacinto College.

"The Piston: Disassembly, Cleaning and Inspection." Prentice Hall Media.

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.6 **TASK:** Cleans engine parts and checks.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.7 TASK: Diagnoses valve train and head malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools and equipment,

EVALUATION: examine the valve train and head of an operable engine and identify the malfunctions.

STANDARD: All malfunctions found by the instructor must be identified.

STUDENT LEARNING EXPERIENCES:

1. Explain purpose and function of valve train and head.
2. Identify and explain the function of:

   cam lift
   valve train
   overhead camshaft
   cam duration
   cam lobe
   cylinder head
   solid valve lifter
   valve
   valve spring
   rocker arm
   push rod
   tappet
   timing gear
   timing chain
   valve guide
   valve seal
   valve rotator
   lifter

3. Describe procedures for detecting defective valves, defective lifters, bent push rods, worn rocker arms, cracked head, blown head gasket, cylinder head warpage, and wiped lobe.
4. Give the valve position (open or closed) for each of the four strokes in a four-stroke cycle engine.
5. Explain reasons for blue, black, or gray exhaust.
6. Describe reasons for excessive oil consumption.
7. Explain causes and effects of worn valve guides and/or valve seals.
8. Explain results of too little or too great rocker-arm-to-valve-stem clearance.
9. Use vacuum gauge to analyze malfunctions such as broken valve spring, incorrect valve timing, and restricted exhaust system.

10. Explain: "I", "F", "L" head
float
surge
lifter pump up
valve overlap

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Display valve train parts; have students identify them and explain function of each.

2. Show filmstirp "Diagnose it First".

3. Discuss function of valve train parts; give quiz concerning material discussed.

4. Remove rocker arm cover from engine, rotate engine, and have students identify stoke-by-valve position.

5. Have students match terms with definitions.

6. Discuss causes of oil consumption through valve guides; identify diagnostic procedures for detecting this problem.

7. Discuss malfunctions of valve train and head and identify diagnostic procedures used to detect them.

8. Introduce water and oil into the intake of an operating engine; choke it; have students observe color of the exhaust.

9. Have students connect vacuum gauge above and below throttle plate and explain reason for different readings.

10. Introduce malfunctions into an operating engine such as loose tappet; have student identify problem.

11. Have students diagnose cause of malfunctions due to valve train.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Oil pressure gauge, compression tester, stethoscope.
2. Basic hand tool set, vacuum gauge, and engine analyzer w/scope.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Parts 2 and 6. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. 8TH ED. Chapter 13. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 14. 1986.

AUDIOVISUAL MATERIAL

"Diagnose it First". Dana Corporation, 551 E. Main St., Hagerstown, Indiana 47346.

4.8 **TASK:** Grinds valves.

PERFORMANCE OBJECTIVE:

Reference - competency 4.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.9 **TASK:** Reconditions cylinder head.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a cylinder head, tools, equipment and service manuals,

EVALUATION: recondition a cylinder head by interpreting for serviceability and replaceing or reconditioning valve guides, resurfacing valve seats and faces, replacing valves, replacing valve seals, and cleaning head.

STANDARD: Head should be clean and meet manufacturer's specifications for usability.

STUDENT LEARNING EXPERIENCES:

1. Define or explain:

   Volumetric efficiency
   interference angle
   knurling
   blueprinting
   squish
   CCing
   quench
   wedging
   porting
   polishing
   bell-mouthing
   lapping

2. Explain or describe: typical valve seat angles
   interference angles
   valve-to-guide clearance

3. Draw a valve and label the following parts: stem, face, margin.

4. Explain causes of valve failures to include: necking, breaking, burning, warping.

5. Explain how valve stems are lubricated.

6. Explain problems associated with no lead gasoline.

7. Give general rules (specifications) for:

   permissible head warp
   valve spring height variation
   valve spring squareness variation
   minimum valve margin width
   installation of springs with correct end toward head
   maximum valve margin width
   maximum stem-to-guide clearance
   minimum spring pressure

8. Demonstrate procedures for:

valve removal and replacement
valve seat reconditioning
valve face reconditioning
knurling
guide removal and installation
measuring of stem-to-guide clearance
testing of valve springs, push rods, and lifters for serviceability
inspection of head for cracks or scratches
detection of head warp
narrowing of valve seat
making three-angle seat
carbon removal

Demonstrate use of:

feeler gauges
straight edge
cleaning brushes
knurling tools
valve shop
inside and outside micrometers
dial indicator
telescoping (snap) gauges
vlave spring compressor

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on cylinder recodnitioning listed under Audiovisual Material.

2. Disucss and explain terms indetified with cylinder head service.

3. Collect unserviceable valves; have students discuss causes of failure and action necessary to prevent recurrence.

4. Discuss causes of and problems associated with valve guide wear.

5. Give comprehensive written test on reconditioning.

6. Have students practice reconditioning of valves, valve guides, and valve seats on discarded heads.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, air blow guns, bay lift, work bench, buffing and wire wheel, service cart.
2. High pressure steam or combination cleaner, compression gauges, cooling systempressure tester, dial indicators, assorted electric drills, and hydraulic press.
3. Assorted micrometers, straight edge, valve guide replacement toll, valve guide resizing tool, valve insert tool, and valve reconditioning equipment.
4. Valve spring compressor, valve spring tester, air impact wrenches, torque wrench (foot/lbs.), telescoping (snap) gauges, and assorted brake adjusting tools.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Units 8-17. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 37. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 13. 1982.

AUDIOVISUAL MATERIAL

"Cylinder Head: Disassembly, Cleaning and Inspection." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

"Grinding Valves." Prentice Hall Media, NY 10591.

"Reassembling the Cylinder Head." Prentice Hall Media, NY 10591.

"Servicing Valve Guides and Seats." Prentice Hall Media, NY 10591.

"Valve Guide Knurling." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

"Valve Service--Cleaning and Inspection." Mt. San Jacinto College, CA 92383.

"Valve Service--Seating and Assembly Procedure." Mt. San Jacinto College, CA 92383.

4.10 TASK: Performs operational inspection of lubrication system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile, tools and gauges and service manual,

EVALUATION: perform an operational inspection of an automobile engine lubrication system following the manufacturer's procedures.

STANDARD: All malfunctions identified by the instructor must be identified. Oil pressure must be measured and compared to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Locate, remove, and replace oil pressure sending unit.
2. Use an oil pressure gauge.
3. List causes of low oil pressure.
4. Define: oil gallery bearing clearance, viscosity, and sludge.
5. Describe oil flow from sump to: filter
   connecting rod bearings
   main bearings
   lifters
   cam lobes
   timing gears or chain
   rocker arm
   distributor drive gear
   and return
6. Explain causes of sludge accumulations and measures to reduce them.
7. Select correct type of engine lubricating oil.
8. Determine when to recommend an engine oil change.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip "The Lubricating and Cooling System".
2. Discuss causes of low oil pressure.
3. Make copies of oil flow diagrams from service manuals; have students place arrows to indicate oil flow direction.
4. Demonstrate use of oil pressure gauge.
5. Have students measure oil pressure and compare results with specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Pressure gauges, tachometer, sending unit removing socket and drive.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 22.12. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 17. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapters 17 and 18. 1986.

AUDIOVISUAL MATERIAL

"The Lubricating and Cooling System." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

4.11 **TASK:** Diagnoses cylinder and bearing malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an engine with defects other than in the cylinder head or camshaft, tools, equipment, and service manuals,

EVALUATION: examine the engine and indentify cylinder and bearing malfunctions.

STANDARD: All defects in the cylinders and bearings of an engine must be correctly identified as determined by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Perform cylinder balance, compression, and leakage tests; inspect lubrication system; diagnose valve train and head malfunctions; diagnose and correct overheating.

2. Identify and explain the function of:

   Pistons, piston rings, crankshaft, crankshaft hournals, oil galleries bearing inserts, and harmonic balancer.

3. Demonstrate procedures for detecting:

   worn, stuck, or broke piston rings, defective harmonic balancers, piston slap, loose piston (wrist) pins, cracked pistons, cracked cylinder, excessive rod, cam or main bearing clearance.

4. Explain how each movable engine part is lubricated.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip "Case of the Slippery Oil".
2. Discuss and demonstrate procedures for detecting cylinder and bearing malfunctions.
3. Copy oil flow diagrams from service manual; have students put in arrows to show direction of oil flow.
4. Have students detect and state reasons for malfunctions in engine cylinder or bearings.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Stethoscope, oil pressure gauge, engine analyzer w/scope, and basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Parts 2 and 6. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 16. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Part 2. 1986.

AUDIOVISUAL MATERIAL

"Case of the Slippery Oil." Dana Corporation, 551 E. Main Street, Hagerstown, IN 47346.

4.12 **TASK:** Inspects crankshaft and connecting rod assembly using micrometers and other equipment.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.13 **TASK:** Reassemble engine block.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given an engine block, tools, equipment and service manuals,
EVALUATION:	reassemble engine block following manufacturer's procedures and specifications.
STANDARD:	On completion, the engine will turn freely with no binding and will have parts correctly installed with no excessive clearances. On starting, there will be no unusual noises, and the oil pressure and coolant temperature will be within limits specified by manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Replace engine mounts, exhaust manifolds, oil pan, oil pump, and engine; recondition cylinder head; and disassemble, clean, and inspect engine.

2. State the general rule for piston ring gap.

3. Demonstrate procedure for:

   determining bearing clearance, determining ring gap,installing bearing inserts and caps, installing camshaft bearings, installing camshaft, installing timing gears and chains, installing piston rings, installing harmonic balancer accomplishing valve timing, honing, installing pistons, installing cylinder heads, and adjusting valves.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstirps on engine assembly listed under Audiovisual Material.

2. Demosntrate assembly procedures.

3. Use several types of piston rings to illustrate types, locations, and installation.

4. Discuss reason for piston ring gap and consequences of too little or too much gap.

5. Have students assemble an engine block in conjunction with an overhaul.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, battery charger, battery jumper cables, vehicle lift, belt tension gauge, work bench, buffing and wire wheel, cam bearing installer, carburetor-distributor adjusting tool, service cart, and cooling system pressure tester.
2. Flat creeper, cylinder deglazer, dial indicators, oil pressure gauge, drop light, and adjustable engine sling.
3. Engine stand, fender covers, flywheel turner, hydraulic press, assorted micrometers, inspection mirrors, piston ring compressor, and radiator pressure tester.
4. Seal installer set, assorted machinist's vises, torque wrench (foot/lbs.), socket, sending unit remove and replace, plastigauge or dial bore gauge.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Unit 17. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Part 6. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 18. 1982.

AUDIOVISUAL MATERIAL

"Completing Engine Assembly." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

"Crankshaft Inspection and Installation." Prentice Hall Media, Tarrytown, NY 10591.

"GM Engine Disassembly and Reassembly." Gould, Inc., Educational System Division, 4423 Arden Dr., El Monte, CA 91731.

"Installation of Camshaft and Timing Chain." Prentice Hall Media, Tarrytown, NY 10591.

"The Piston: Assembly and Installation." Prentice Hall Media, Tarrytown, NY 10591.

4.14 **TASK:** Replaces ring(s) on piston(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5, 4.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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4.15 **TASK:** Replaces piston(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 4.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.16 **TASK:** Replaces connecting rods and bearings.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5, 4.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.17 **TASK:** Inspects head for warp.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5, 4.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.18 **TASK:** Replaces camshaft.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.9, 4.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.19 **TASK:** Replaces camshaft bearings.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5, 4.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.20 **TASK:** Replaces timing gears and chain.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.5, 4.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.21 TASK: Replaces flywheel.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manual,

EVALUATION: Replace the flywheel following manufacturer's specifications and procedures.

STANDARD: When completed, the clutch and transmission will operate as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Replace clutch assembly.
2. Describe the function and construction of flywheel.
3. Describe the symptoms of malfunctioning flywheels.
4. Explain methods for diagnosing need for flywheel replacement.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss replacement of flywheel due to clutch or starter malfunctions.
2. Discuss relationship of flywheel to enigne moving parts, starting system, and clutch.
3. Have students research text and list reasons to replace the flywheel; discuss the possible symptoms of malfunctions.
4. Discuss methods for determining if clutch or starter problems are related to the flywheel.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, fluid dispenser, basic hand tool set, clutch disc aligning tool, flywheel turning/holding tool, and transmission jack.

RESOURCES:

Manufacturer's service manuals.

AUDIOVISUAL MATERIAL

"The Flywheel and Oil Pump." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

4.22 **TASK:** Removes and replaces oil pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational engine, tools, equipment and service manual,

EVALUATION: replace the oil pump following manufacturer's procedures.

STANDARD: After installation, there must be no oil leaks and oil pressure must meet manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Remove and replace oil pan and check oil pressure.
2. Clean and install oil pick-up tube and screen.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review removal and replacement of oil pan.
2. Demonstrate cleaning of pick-up screen and installation of pick-up tube.
3. Have students replace an oil pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, chains and blocking materials, chain hoist or equivalent, oil pressure gauge, flywheel turner, and oil filter wrench.
2. Basic hand tool set, engine sling or chain, gasket scraper, and oil drain equipment.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 17. 1982.

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.23 **TASK:** Replaces valve lifters.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.24 **TASK:** Replaces gaskets and seals.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.27

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.25 **TASK:** Replaces cylinder heads and intake manifold.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given cylinder heads, intake manifold, gaskets, tools, equipment, and service manuals,

EVALUATION: replace cylinder heads and intake manifold following manufacturer's procedures and specifications.

STANDARD: On completion, there must be no gasoline, water or oil leaks, and compression must be normal.

STUDENT LEARNING EXPERIENCES:

1. Use technical (service) manual.
2. use a torque wrench.
3. Select appropriate gasket sealers.
4. Identify "top" side of head and manifold gasket.
5. Explain general rule for head-tightening sequence when no sequence is specified.
6. Explain consequences of improper torque value or tightening sequence.
7. Replace rocker arms and push rods.
8. Adjust tappets.
9. Adjust a carburetor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students research and outline procedure for removal and replacement of cylinder head and intake manifold.

2. Have students draw a cylinder head bolt-tightening pattern for an engine of their choice; have them specify torque readings.

3. Discuss consequences of incorrect head gasket placement.

4. Demonstrate torquing procedures and explain consequences of improper values.

5. Have students practice adjusting tappets on engines with hydraulic and solid valve lifters.

6. Have students remove, recondition, and replace a cylinder head in conjunction with an engine overhaul.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender covers, torque wrench, distributor puller, basic hand tool set, pry bars, belt tension gauge, and radiator pressure tester.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Paragraphs 17.10-17.12 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Part 2, Chapter 37. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 15. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 15. 1986.

AUDIOVISUAL MATERIAL

"Cylinder Head and Pan Removal." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.26 **TASK:** Adjusts valves.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.25

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.27 **TASK:** Removes and replaces oilpan.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile, tools, equipment, and service manual,

EVALUATION: remove and replace the oil pan following manufacturer's recommended procedures.

STANDARD: Upon replacement, there will be no oil leaks from or around the oil pan.

STUDENT LEARNING EXPERIENCES:

1. Identify types and uses of gaskets and gasket materials.
2. Identify types and uses of cleaning tools and materials such as solvents.
3. Use gasket sealer, etc.
4. Steam clean engine.
5. Determine oil pan removal procedures from service manual.
6. Remove and replace starters, cross links, and tie rods.
7. Demonstrate procedures for raising engine and securing it in the lifted position.
8. Demonstrate procedure for straightening pan-bolt hole area.
9. Explain oil pan replacement procedures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students use service manuals to determine oil pan removal and replacement procedures for different vehicle.

2. Demonstrate use of gaskets, scrapers, and sealants.

3. Demonstrate procedures for lifting engine and straightening of pan.

4. Discuss types and uses of gasket materials.

5. Demonstrate replacement of oil pan.

6. Have students remove and replace an oil pan.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, chains and blocking materials, chain hoist or equivalent, flywheel turner, and basic hand tool set.
2. Oil filter wrench, engine sling or chain, gasket scraper, oil fill equipment, and oil drain equipment.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 38.5. 1980.

AUDIOVISUAL MATERIAL

"Cylinder Head and Pan Removal." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.28 **TASK:** Diagnoses condition of, repairs, or replaces positive crankcase ventilation system components.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an engine, tools, and equipment,

EVALUATION: perform operational inspections of the positive crankcase ventilation (PCV) system following manufacturer's procedures and repair or replace system components.

STANDARD: All malfunctions identified by the instructor must be recognized.

STUDENT LEARNING EXPERIENCES:

1. Identify vacuum hoses and connections.
2. Describe the construction and operation of a PCV system.
3. Locate the PCV valve.
4. Explain how to test the PCV system.
5. Use a tachometer.
6. Identify PCV system components that can malfunction and describe the symptoms of each malfunction.
7. Demonstrate the techniques and tools used to troubleshoot and repair PCV systems.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate testing of the PCV system.
2. Use an automobile to locate the components of a PCV system and describe the function of each component.
3. Introduce malfunctioning components and air leaks into the system; have students identify the problem.
4. Show filmstrips listed under Audiovisual Material.
5. use several types of PCV valves to illustrate operation, types, and locations.
6. Have students, in conjunction with tune-ups, test several PCV systems.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tachometer and PCV tester.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 34. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 17. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 51.5. 1986.

AUDIOVISUAL MATERIAL

"Emissions Controls." Ford Motor Company, Training and Publications Department, 912 Parklane Tower West, Dearborn MI 48126.

"PCV Systems." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

4.29 **TASK:** Repairs or service crankcase ventilation system.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.28

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.30 **TASK:** Inspects exhaust system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a complete exhaust system,

EVALUATION: identify all parts and all malfunctions of the system and repair exhaust system.

STANDARD: Exhaust system must be repaired to meet instructor's approval.

STUDENT LEARNING EXPERIENCES:

1. Write two purposes of the exhaust system.
2. Identify all components of the exhaust system.
3. Identify tools used in exhaust system work.
4. Demonstrate removal and replacement of exhaust manifold.
5. Demonstrate removal and replacement of mufflers and tailpipes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain exhaust system components; purpose and application.
2. Explain types of mufflers.
3. Explain operation of manifold heat riser valve.
4. Demonstrate proper usage of muffler and tailpipe repair tools.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, hacksaw, and muffler/tailpipe tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 7. 1980.

4.0 **COMPETENCY/SKILL:** Engine Overhaul.

4.31 **TASK:** Replaces muffler.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.30

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.32 **TASK:** Replace tail pipe assemblies.

PERFORMANCE OBJECTIVE:

Reference - Competency 4.30

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.33 **TASK:** Performs operational inspections of positive crankcase ventilation system(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 4.28

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

4.34 **TASK:** Inspects exhaust system(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 4.30

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.0 COMPETENCY/SKILL: Maintains and repairs power trains.

5.1 **TASK:** Adjusts external shift linkage on manual transmission.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a manual transmission, tools, equipment, and service manual,

EVALUATION: adjust the external shift to meet manufacturer's specifications.

STANDARD: The transmission must shift correctly into all gears.

STUDENT LEARNING EXPERIENCES:

1. Clean a transmission.
2. Identify the types of external shift linkages on manual transmissions.
3. Demonstrate the method for adjusting an external shift linkage on a manual transmission.
4. Use the specialized tools for adjusting external shift linkages on manual transmissions.
5. Explain problems caused by incorrectly adjusted shift linkages.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss symptoms of incorrectly adjusted shift linkage.
2. Use several makes and models of vehicles to illustrate linkage types and to demonstrate adjustment procedures.
3. Have students adjust external shift linkage.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, and drill index.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 47.5. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 4. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 25. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 35. 1986.

5.2 **TASK:** Inspect drive shaft, U-joints, and center bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a drive line assembly with known defects, tools, equipment, and service manual,

EVALUATION: inspect the drive shaft, U-joints and center bearing(s) for malfunctions.

STANDARD: All defects must be identified and verfied by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Identify the types and parts of and the technical terms associated with drive lines.
2. Identify the parts for the following U-joints: Cardon, constant velocity, and cross and roller.
3. Identify and demonstrate using the tolls necessary for drive line repair.
4. Demonstrate inspection methods for U-joints, center bearings, and drive shafts.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show the filmstrips REAR AXLE AND DRIVE SHAFT--PRINCIPLES OF OPERATION and DRIVE SHAFT AND U-JOINTS EXPLAINED.

2. Discuss construction, function, and components of types of drive lines and U-joints.

3. Demonstrate techniques for inspecting U-joints, center bearings, and drive line.

4. Have students inspect a drive line.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, and hose clamps.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 22. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 27. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 39.3. 1986.

AUDIOVISUAL MATERIAL

"Drive Shaft and U-Joints Explained." Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

"Rear Axles and Drive Shaft--Principles of Operation." Ford Motor Company, Training and Publications Dept., Parklane Tower West, Dearborn, Michigan 48126.

5.3 **TASK:** Diagnose differential malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with known differential defect(s), tools, equipment, and service manuals,

EVALUATION: identify the malfunction(s) and report the findings to the instructor.

STANDARD: All malfunction(s) identified by the instructor must be recognized.

STUDENT LEARNING EXPERIENCES:

1. Describe operation and types of differential and rear axle assemblies.
2. Locate and identify all parts of the differential and axle assembly assembly.
3. Differentiate between conventional and planetary differentials.
4. Identify various types of differential carrier housings.
5. Identify types of rear axle shafts and bearings.
6. Identify differential and axle assembly malfunctions and diagnostic procedures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip "Automotive Differential Explained".
2. Explain the types of differential lubricants and problems that may occur if the wrong type is used.
3. Have students count teeth on ring and pinion gears and determine gear ratio.
4. Have students write a short paper on the purposes of the rear axle assembly.
5. Provide an exploded view of the rear axle assembly and have students match names with parts.
6. Discuss types of differential carrier housings and rear axle shafts.
7. Discuss types of bearings and seals.
8. Use parts from a discarded automatic transmission or differential to demonstrate planetary gear action.
9. Have students disassemble a rear axle, name the parts, describe the operation, and reassemble.
10. Disassemble a limited slip differential, identify the parts, describe the operation, and reassemble.
11. Have students identify defects in gear tooth patterns.
12. Show filmstrip REAR AXLE DIAGNOSIS AND REPAIR.
13. Discuss typical differential malfunctions and their symptoms; have students match lists of malfunctions and symptoms.
14. Have students diagnose the defects in a differential.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Stethoscope, floor jack and jack stands

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 51. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 23. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 28. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 40. 1986.

AUDIOVISUAL MATERIAL

"The Automotive Differential Explained." Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

"Differential Assembly and Adjustment." Mt. San Jacinto College, Multi-Media Ofc. 21400 Hwy 79, San Jacinto, CA 92383.

"Rear Axle Diagnosis and Repair." Ford Motor Company, Training and Publications Dept., 912 Parklane Tower West, Dearborn, MI 49126.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.4 **TASK:** Diagnose manual transmission operation.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle with a malfunction in the manual transmission, tools, equipment, and service manual,
EVALUATION:	operate the manual transmission in all gears and accurately identify all malfunctions.
STANDARD:	All malfunctions must be identified as verified by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Perform pre-checks on fluid level and adjustment.
2. Explain the operation of a manual transmission.
3. Describe the symptoms of transmission malfunctions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip "Manual 3 and 4 Speed Transmission--Diagnosis and Testing".
2. Cut away case of transmission to show internal parts; have students trace power flow in each gear.
3. Discuss typical defects and the symptoms and diagnostic procedures for each.
4. Discuss why pre-checks are necessary.
5. Have students road test vehicle and use lift to diagnose transmission defects.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, and stethoscope.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 44 and 45. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 5TH ED. Chapter 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 25. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 33. 1986.

AUDIOVISUAL MATERIAL

"Manual 3 and 4 Speed Transmissions--Diagnosis and Testing." Ford Motor Co., Training and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 48126.

5.5 **TASK:** Replaces universal joints.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with malfunctioning universal joints, tools, equipment and service manual,

EVALUATION: replace the universal joints following manufacturer's procedure and specifications.

STANDARD: When completed the universal joints must function without excessive noise or vibration.

STUDENT LEARNING EXPERIENCES:

1. Explain and demonstrate the replacement of U-joints.
2. Remove and replace drive shaft.
3. Demonstrate the use of specialized tools for replacing U-joints.
4. Demonstrate the lubrication of U-joints.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show the filmstrips "Removing and Disassembling a Drive Shaft and U-Joints and Installing the Drive Shaft".
2. Demonstrate the use of U-joint press.
3. Demonstrate removal and replacmeent of U-joints, using sockets and vise in palce of U-joint press.
4. Have students lubricate U-joints.
5. Have students replace a U-joint.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, U-joint press or hydraulic press, vehicle lift, bench vise and sockets.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 5TH ED. Chapter 22. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 27. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 39.3. 1986.

AUDIOVISUAL MATERIAL

"Assembling U-Joints and Installing The Drive Shaft. Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytiown, NY 10591.

"Removing and Disassembling a Drive Shaft and U-Joints." Prentice Hall Media.

5.6 **TASK:** Replaces driveline seals.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools, and equipment,

EVALUATION: lift vehicle, inspect driveline seals, and replace all defective parts.

STANDARD: There shall be no seal leaks, and the driveline will be secure.

STUDENT LEARNING EXPERIENCES:

1. Explain types of driveline seals.
2. Demonstrate replacement of driveline seals.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain types of driveline seals.
2. Explain reasons for seal failure.
3. Demonstrate replacement of driveline seals.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, transmission seal drivers kit, chassis hoist, and driveline seals.

RESOURCES:

Manufacturer's service manuals.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.7 **TASK:** Replaces pinion seal.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a leaking pinion seal, hand tools, equipment and service manuals,

EVALUATION: replace pinion seal according to manufacturer's procedures.

STANDARD: The pinion seal must not leak during operation.

STUDENT LEARNING EXPERIENCES:

1. Describe symptoms related to incorrect bearing preload.
2. Identify the parts of a conventional differential.
3. Identify the parts of a planetary differential.
4. Use seal puller and installer.
5. Interpret technical (service) manuals.
6. Explain and demonstrate the "preloading" of bearings.
7. Remove pinion yolk or flange.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss relationship of pinion to ring gear.
2. Demonstrate use of puller to remove drive pinion flange.
3. Demonstrte removal and replacement of seal.
4. Discuss the reason for preloading bearings.
5. Show the filmstirp "Replacing the Differential Pinion Shaft and Oil Seal".
6. Have students select from a list of differential malfunction symptoms those related to incorrect pinion bearing preload.
7. Have students use service manuals to write an outline of procedures and specifications.
8. Have students replace a pinion seal.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, appropriate puller and seal remover/installer.
2. Specialized yolk holding and removing tools, and dial indicator.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 23. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 28. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 41.6. 1986.

AUDIOVISUAL MATERIAL

"Replacing the Differential Pinion shaft and Oil Seal." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

5.8 **TASK:** Lubricates speedometer cable, drive gear and housing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools and supplies,

EVALUATION: remove speedometer cable and gear housing, lubricate, and replace units.

STANDARD: The speedometer must be operative and all parts secure as checked by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Identify speedometer system parts.
2. Demonstrate lubrication of speedometer cable.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain nomenclature of speedometer cable system.
2. Explain types of cable lubricants.
3. Demonstrate removal lubrication, and replacement of speedometer cable.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, graphite lubricant, shop rags, hoist (chassis), and lithium grease.

RESOURCES:

5.9 **TASK:** Replaces manual transmission.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a manual transmission, tools, equipment and service manual,

EVALUATION: replace the transmission following manufacturer's procedures and specifications.

STANDARD: The transmission must function as specified by the manufacturer upon completion.

STUDENT LEARNING EXPERIENCES:

1. Replace drive shaft.
2. Use transmission jack.
3. Use blocking and lifting devices.
4. Adjust fluid level and linkage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss transmission removal and replacement procedures.
2. Have students remove and replace a transmission in conjunction with throw-out bearing and clutch service.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, fluid dispenser, transmission jack, and clutch aligning tool.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 47.3 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 6. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 25. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 35.9. 1986.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.10 **TASK:** Replaces clutch disc and pressure plate.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a mechanical or hydraulic clutch, tools, equipment and service manuals,

EVALUATION: replace the clutch assembly following manufacturer's procedures and specifications.

STANDARD: Upon completion, the clutch mechanism will not have excessive noise and will operate without slippage or excessive pedal pressure.

STUDENT LEARNING EXPERIENCES:

1. Replace transmission.
2. Explain the purpose and operation of conventional clutches.
3. Use a clutch alignment tool.
4. Describe the various pressure plates and discs.
5. Explain problems associated with defective clutch or pressure plate.
6. List problems caused by incorrect transmission alignment.
7. Explain conditions necessitating flywheel resurfacing.
8. List causes of premature clutch failures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on clutch removal and replacement listed under Selected Audiovisual Materials.
2. Discuss the construction and operation of different pressure plates and discs.
3. Discuss clutch malfunctions and the causes and symptoms of the problems.
4. Use discarded discs and pressure plates to illustrate types of failures.
5. Have students remove transmission and bell housing, if necessary. Demonstrate removal and replacement of disc and pressure plate.
6. Have students replace a clutch disc and pressure plate.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, clutch disc aligning tool, fluid dispenser, transmission jack, and basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 45. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 24. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 33. 1986.

AUDIOVISUAL MATERIAL

"Installing a Clutch." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

"Removing a Clutch." Prentice Hall.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.11 **TASK:** Replaces pilot bearings.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.10

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.12 **TASK:** Replaces speedometer cable, drive gear and housing.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.8

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.13 **TASK:** Replaces clutch release bearing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment and service manuals,

EVALUATION: replace the clutch release bearing following manufacturer's procedures and specifications.

STANDARD: Upon completion, the clutch will operate within specifications and without excessive noise.

STUDENT LEARNING EXPERIENCES:

1. Adjust the clutch.
2. Explain the purpose and operation of throw-out bearing.
3. Use a transmission jack.
4. Remove and replace a manual transmission and bell housing.
5. Explain symptoms of defective throw-out bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use pressure plate, disc, flywheel, and throw-out bearing to illustrate function of bearing and symptoms of a defective bearing.
2. Have students replace throw-out bearing.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, and transmission jack.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 45. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapters 2 and 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 24. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 33. 1986.

5.14 **TASK:** Replaces rear axle shaft, bearing, and seal.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment and service manuals,

EVALUATION: replace the rear axle shaft, bearing and seal following manufacturer's procedures and specifications.

STANDARD: Upon completion there will be no leaks in the rear axle assembly and the assembly will operate correctly.

STUDENT LEARNING EXPERIENCES:

1. Use specialized pullers and seal installers for axle shaft and bearings.
2. Explain the difference between "full floating" and "semi-floating" axles and "live" and "dead" axles.
3. Demonstrate removal and replacement of rear axle, bearings, and seal.
4. Describe the two most common methods of retaining the axle in the rear axle housing.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss methods for retaining axle shaft in housing and for determining the type of retainer from service manuals such as Mitchell's.
2. Study exploded views of full-floating and semi-floating rear axle shafts; discuss advantages and disadvantages of each.
3. Describe the difference between "live" and "dead" axles.
4. Discuss ways to modify rear axle assemblies to meet NHRA requirements.
5. Demonstrate installation of seals.
6. Demonstrate use of pullers to remove axle shaft and seals.
7. Have students replace a rear axle, bearing, and seal.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Hydraulic press with attachments, basic hand tool set, impact wrench (1/2" drive with sockets).
2. Specialized pullers and seal installers, floor jack and jack stands.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 23. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 28. 1982.

AUDIOVISUAL MATERIAL

"Rear Axles and Bearing Seals." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

5.15 **TASK:** Repairs hydraulic-type clutch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a failing hydraulic clutch, tools, and supplies,

EVALUATION: inspect the clutch master and slave cylinders and repair all defective parts.

STANDARD: Upon completion the clutch shall be operative with no hydraulic leaks as checked by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Discuss diagnosis of hydraulic clutch failures.
2. Examine clutch cylinder(s) for reusability.
3. Demonstrate rebuilding of clutch cylinders.
4. Demonstrate replacement and hydraulic bleeding of clutch cylinders.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain hydraulic clutch failures.
2. Demonstrate inspection, rebuilding and replacement of a hydraulic clutch cylinder.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, 3/8 drill motor, wheel cylinder hone(s), assembly fluid, brake fluid, clean shop towels.
2. Clutch cylinder pressure bleeder, and clutch cylinder repair kit.

RESOURCES:

Manufacturer's service manuals.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.16 **TASK:** Rebuilds manual transmission.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.15

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.17 **TASK:** Rebuilds overdrive unit.

PERFORMANCE OBJECTIVE:

Reference - Competency n/a

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.18 **TASK:** Adjusts external shift linkage on manual transmission.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.19 **TASK:** Adjusts clutch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a standard transmission, tools, equipment, and service manuals,

EVALUATION: adjust the clutch to meet manufacturer's specifications.

STANDARD: Upon completion, the clutch will not slip and will fully disengage and free play will be correct.

STUDENT LEARNING EXPERIENCES:

1. Describe the types of clutch linkages.
2. Define and explain the term free play.
3. Demonstrate methods used to adjust clutch linkages.
4. Use the various specialized tools needed to adjust a clutch.
5. Explain the function of each clutch system component.
6. Explain problems associated with too little or too much free play.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss clutch operation and importance of correct clutch free play.
2. Use several vehicles with mechanical or hydraulic clutches to illustrate linkages and their adjustment procedures.
3. Have students adjust one or more clutches.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, and basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 45. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 3 and 32. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 34. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 33. 1986.

5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.20 **TASK:** Repairs or replaces differentials.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.19

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.21 **TASK:** Repairs or replaces spider gear.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.20

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

5.22 **TASK:** Balances drive shaft (in car).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with rear driven wheels and an unbalanced drive shaft, tools, and equipment,

EVALUATION: balance the drive shaft using hose clamps.

STANDARD: On completion, there must be no drive shaft vibrations due to imbalance at any road speed up to 65 mph.

STUDENT LEARNING EXPERIENCES:

1. Inspect drive shaft, U-joints, and center bearings.
2. Identify causes of imbalance.
3. Eliminate vibrations due to causes other than drive shaft imbalance.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review drive shaft, U-joint, and center bearing inspection.
2. Discuss causes of imbalance.
3. Discuss causes of vibration other than imbalance.
4. Have students balance a drive shaft that has been unbalanced by instructor welding a piece of metal to it.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, basic hand tool set, and hose clamps.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., NY. 6TH ED. Paragraph 22.6. 1983.

5.23 **TASK:** Analyzes and repairs electronic control circuit and components on overdrive units.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools, and equipment,

EVALUATION: evaluate the function of the overdrive system, troubleshoot system problems and repair as necessary.

STANDARD: Upon completion, the vehicle overdrive shall operate correctly or the instructor will be made aware of the defective, nonrepairable parts.

STUDENT LEARNING EXPERIENCES:

1. Student should be competent in Area 7, Tasks: 19, 16 and 29.
2. Discuss operation of electronic controlled overdrive units.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Check for student competency in Area 7, Tasks: 16, 19, and 29.
2. Explain operation of electronic controlled overdrive units.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, digital volt-ohmmeter, vehicles with eletronic overdrive, chassis hoist, and factory service manual.

RESOURCES:

Manufacturer's service manuals
National Service Data manuals

5.24 **TASK:** Repairs, replaces or adjusts front-drive axle assemblies.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a faulty front-drive axle, tools and service manuals,

EVALUATION: Lift and secure the vehicle, inspect the axle assemblies, note all faulty parts and then repair or replace as necessary.

STANDARD: Upon completion, the vehicle must be in an operative condition.

STUDENT LEARNING EXPERIENCES:

1. Inspect front-drive axle assemblies.
2. Discuss different types of axle repairs.
3. Demonstrate proper removal, repair and replacement of front-drive axles.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain inspection of front-drive axles.
2. Explain different types of axles repairs.
3. Demonstrate proper removal, repair, and replacement of front-drive axle assemblies.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, 1/2" impact wrench.
2. Chassis hoist, and front wheel drive tool kit.

RESOURCES:

Manufacturer's service manuals.

AUDIOVISUAL MATERIAL

Ford, GM, Nissan - Front Wheel Drive Repair, available on videocassette.

5.25 TASK: Removes and replaces a propeller shaft.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective propeller shaft, tools, equipment and service manuals,

EVALUATION: replace the propeller shaft according to manufacturer's procedures and specifications.

STANDARD: Upon completion, U-joints must be secure and transmission oil level must be correct.

STUDENT LEARNING EXPERIENCES:

1. Adjust transmission fluid level.
2. Demonstrate procedures for removing and replacing the propeller shaft.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate adding fluid to automatic and manual transmissions.
2. Discuss and demonstrate procedures for removing and replacing a drive shaft.
3. Have students remove and replace a drive shaft on a vehicle.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and vehicle lift.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 5TH ED. Chapter 22. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 27. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 39.3. 1986.

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5.0 **COMPETENCY/SKILL:** Maintains and repairs power trains.

5.26 **TASK:** Road test inspections of differentials.

PERFORMANCE OBJECTIVE:

Reference - Competency 5.23

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

6.0 COMPETENCY/SKILL: Maintains and repairs automatic transmission(s).

6.1 TASK: Adjusts shift linkage.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given service manuals, tools and equipment,

EVALUATION: adjust the transmission linkage on a given vehicle following manufacturer's specifications and recommended procedures.

STANDARD: Upon completion, the transmission must shift securely into park, neutral, reverse and all drive ranges.

STUDENT LEARNING EXPERIENCES:

1. Explain procedures for adjusting column- and floor-mounted shifts.

2. Describe symptoms of malfunctions that occur due to incorrectly adjusted shift linkage.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss problems associated with incorrectly adjusted linkage.

2. Have each student select a particular vehicle make and model; have them use service manuals to determine adjustment procedures and explain these procedures to the class.

3. Have students adjust shift linkage.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, drill index and vehicle lift.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 37.8. 1986.

Manufacturer's service manuals

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.2 **TASK:** Adjusts linkage from steering column to automatic transmission.

PERFORMANCE OBJECTIVE:

Reference - Competency 6.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.3 **TASK:** Adjusts linkages from engine to automatic transmission.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission, tools, equipment and service manuals,

EVALUATION: adjust the engine to transmission linkage according to manufacturer's procedures and specifications.

STANDARD: Upon completion, transmission must shift into the correct gear at the proper speed and throttle opening.

STUDENT LEARNING EXPERIENCES:

1. Adjust shift linkage.
2. Demonstrate the procedure for adjusting TV linkage.
3. Demonstrate the procedure for adjusting passing gear linkage or cable.
4. Explain symptoms caused by incorrectly adjusted linkage.
5. Describe causes, other than incorrectly adjusted linkage, for transmission failing to shift into or out of passing gear.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the internal opeation of a transmission in passing mode and symptoms of incorrectly adjusted linkage.

2. Discuss symptoms of transmission defects that may be confused with symptoms of incorrectly adjusted linkages.

3. Demonstrate adjustment of engine-to-transmission linkages.

4. Have students determine procedure for adjusting engine-to-transmission linkage; have them complete the adjustment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

Basic hand tool set, drill index, and special tools as specified in repair procedures.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Manufacturer's service manuals

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.4 **TASK:** Cleans and visually inspects transmission.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, and cleaning materials,

EVALUATION: clean the transmission and inspect it for leaks under the instructor's superivsion.

STANDARD: All transmission leaks identified by the instructor must be diagnosed.

STUDENT LEARNING EXPERIENCES:

1. Use a steam cleaner.
2. Explain common causes of transmission leaks.
3. Explain symptoms of low fluid level.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss causes and locations of transmission leaks.
2. Discuss symptoms of low transmission fluid.
3. Have students clean a transmission and examine it for leaks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Steam cleaner, solvents, and vehicle lift.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

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6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.5 **TASK:** Replaces or adjusts modulators.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective or incorrectly adjusted modulator valve, service manuals, tools, and equipment,

EVALUATION: Service the modulator valve to meet manufacturer's specifications for proper operation.

STANDARD: Upon completion, the vehicle must shift smoothly at the correct road speed.

STUDENT LEARNING EXPERIENCES:

1. Identify the types of modulators.
2. Locate the modulator.
3. Explain the function of the modulator.
4. Use a vacuum gauge and a vacuum pump tester.
5. Distinguish between adjustable and non-adjustable modulators.
6. Explain the symptoms of defective or incorreclty adjusted modulators.
7. Explain the relationship between engine condtion and transmission performance.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use cutaways of modulators and a valve body to illustrate types and functions of modulators.
2. Discuss the relationship between transmission performance and engine condition.
3. Demonstrate procedures to diagnose a defective modulator in a vehicle; have students diagnose the problem.
4. Place a defective modulator in a vehicle; have students use procedures to detect the problem.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vacuum gauge, vacuum pump, basic hand tool set and vehicle lift.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 36 and 37. 1986.

Manufacturer's service manuals

6.6 **TASK:** Inspects and repairs transmission cooling system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission,

EVALUATION: lift the vehicle and secure it, inspect the transmission cooling lines and radiator for leakage and repair as necessary.

STANDARD: Upon completion, there will be no leaks and the system will operate properly.

STUDENT LEARNING EXPERIENCES:

1. Discuss fluid flow for transmission cooling.
2. Discuss cause(s) of leaks in sytem.
3. Demonstrate cooling line repair.
4. Check transmission fluid for engine coolant contamination.
5. Check engine collant for transmission fluid contamination.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain fluid flow for transmission cooling system.
2. Explain cause(s) of internal and external leaks.
3. Demonstrate cooling line repair.
4. Demonstrate contamination checks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, hoist (optional), hose clamps, tubing cutter, floor jack and jack stands, drain pan and transmission cooling line (rubber).

RESOURCES:

AUTOMATIC TRANSMISSION, Check Chart Series, Canfield Press.

Manufacturer's shop manuals.

AUDIOVISUAL MATERIAL

In - Check Chart Manual.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.7 **TASK:** Replaces front pump, seal, and bushing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile with malfunctions in the transmission front pump, tools, equipment and service manuals,

EVALUATION: remove and replace the front pump, seals and bushing according to manufacturer's specifications.

STANDARD: After replacement, the pump will not leak, transmission will operate according to manufacturer's specifications, and pressure will be within specified limits.

STUDENT LEARNING EXPERIENCES:

1. Remove and replace transmission and torque converter.
2. Use a pressure gauge.
3. Use special tools associated with pump and bushing removal and replacement.
4. Explain the function and operation of front pump.
5. Identify pump gear wear.
6. Diagnose problems associated with a defective front pump.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate use of pressure gauge to diagnose pump defects.

2. Use classroom transmission to demonstrate removal, inspection, and replacement of pump and bushing.

3. Have students remove and replace front pump, bushing, and seal in conjunction with transmission overhaul.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Drain pan, transmission jack, fluid fill equipment, flywheel turning/holding tool, blocking materials and equipment.
2. Basic hand tool set, engine saddle tool, alignment dowel rods, slide hammer puller, and vehicle lift.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

AUDIOVISUAL MATERIAL

"C-4 Transmission--Disassembling and Inspecting the Front Pump and Forward Gear Train." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.8 **TASK:** Installs automatic transmission cooler.

PERFORMANCE OBJECTIVE:

Reference - Competency 1.8

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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6.9 **TASK:** Replaces manual transmission rear seal and bushing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a standard transmission, hand tools, equipment and service manuals,

EVALUATION: replace the rear seal and bushing following manufacturer's procedures.

STANDARD: Upon completion, there will be no leaks or excessive noise in the repaired areas and no excessive play in the drive shaft slip yoke.

STUDENT LEARNING EXPERIENCES:

1. Replace drive shaft and adjust fluid level.
2. Demonstrate the use of the various specialized tools to remove and replace transmission seals, gaskets, and bushings.
3. Use technical (service) manuals.
4. Explain methods for determining when seal or bushing needs to be replaced.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate replacement of bushing and seal.
2. Discuss symptoms of defective seals and bushings and the diagnostic techniques used to identify each defect.
3. Have students re-bush and re-seal extension housing.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, bushing cutter, bushing driver, seal installer, chain and blocking materials, basic hand tool set, engine saddle tool.
2. Chain hoist or engine lift, and fluid dispenser.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 6. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 25. 1982.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.10 **TASK:** Performs a road test for transmission diagnosis.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission and a service manual,

EVALUATION: perform a road test on an automatic transmission to diagnose any problems that exist.

STANDARD: All problems identified by the instructor must be detected.

STUDENT LEARNING EXPERIENCES:

1. Explain causes of no shifts or "missing" gear.
2. Adjust fluid level at operating temperature.
3. Diagnose malfunctions based on color and odor of ATF.
4. Explain causes of erratic or harsh shifts.
5. Explain causes of thumps, grinding, and buzzing noises.
6. Perform a stall test.
7. Use pressure and vacuum gauges.
8. Make notes on times and speed when shifts occur.
9. Interpret technical (service) manuals, particularly diagnostic charts.
10. Check passing gear operation.
11. Compare recorded notes to manufacturer's specifications.
12. Identify towing limitations for specified makes and models.
13. Read transmission oil flow and pressure diagrams.
14. Explain the function, construction, and operation of all components.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show one or more of the filmstirps listed under Selected Audiovisual Materials.

2. Discuss operation of automatic transmissions.

3. Discuss common defects of transmissions, symptoms of them, and diagnostic procedures to follow.

4. Make a list of symptoms for several transmission malfunctions; have students use service manuals to determine possible causes.

5. Have students identify towing limitations for various makes and models and describe damage that may result from deviation from limitations.

6. Discuss stall test procedures, precautions, and results.

7. Have students road test vehicles with pressure gauges attached and record pressures, and shift points.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Oil pressure gauge, tachometer, basic hand tool set, and vacuum gauge.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 6. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapters 36 and 37. 1986.

AUDIOVISUAL MATERIAL

"Automatic Transmission Diagnosis." Ford Motor Company, Training and Publications Dept., 912 Parklane Tower West, Dearborn, MI 48126.

"Automatic Transmission Erratic Shifts--Diagnosis." Ford Motor Co.

"Automatic Transmissions--Troubleshooting." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.11 **TASK:** Removes and installs automatic transmission.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission, tools, equipment and service manuals,

EVALUATION: replace the transmission according to manufacturer's specifications and procedures.

STANDARD: Upon completion, the transmission will operate without leaks, vibrations, or unusual noises and shift according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Use a transmission jack.
2. Adjust linkages and switches.
3. Adjust fluid level.
4. Select correct type of ATF.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss transmission removal and replacement procedures.
2. Have students remove and replace an automatic transmission and road test the vehicle after installation.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Drain pan, fluid fill equipment, vehicle lift, engine saddle tool, basic hand tool set, transmission jack.
2. Flywheel turning/holding tool, blocking material and equipment, and alignment dowel rods.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

AUDIOVISUAL MATERIAL

"Automatic Transmission, Repair and Replace." Gould, Inc., Educations Systems Div., 4423 Arden Dr., El Monte, CA 91731.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.12 **TASK:** Makes band adjustments (internal or external).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission, tools, equipment, and service manuals,

EVALUATION: make adjustments on the automatic transmission bands following manufacturer's procedures and specifications.

STANDARD: Upon completion, the bands will engage fully and will not slip and transmission will shift as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Locate the band adjusters.
2. Obtain the correct specifications.
3. Service filter.
4. Adjust fluid level.
5. Use torque wrench and specialized adjusting tools.
6. Explain symptoms caused by bands that are too loose or too tight.
7. Diagnose band and clutch condition, based on color and odor of ATF.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Reveiw draining and refilling procedures.

2. Use a classroom transmission to explain band adjustment and symptoms of incorrectly adjusted bands.

3. Demonstrate band adjustment.

4. Discuss diagnosis of bands and clutches, based on odor and color of ATF. Illustrate, using samples of "burned" oil.

5. Have students adjust bands in conjunction with filter change.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, torque wrench (inch/lbs.), assorted special transmission tools, basic hand tool set, drain pan, and fluid fill equipment.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 37.8. 1986.

6.13 **TASK:** Services backup light switch or neutral safety switch.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective or incorrectly adjusted neutral safety switch or backup light switch, proper tools, equipment, and service manual,

EVALUATION: adjust or replace the component to operate according to manufacturer's specifications.

STANDARD: Upon completion, the vehicle must start only in park or neutral and backup light must come on only when vehicle is in reverse gear.

STUDENT LEARNING EXPERIENCES:

1. Repair shorted or open circuits.
2. Explain location and types of backup light and neutral safety switches.
3. Read wiring diagrams.
4. Explain how a neutral safety switch disables cranking circuit.
5. Demonstrate the procedure for adjusting a switch.
6. Demonstrate procedures for diagnosing a malfunctioning neutral safety or backup light switch.
7. Demonstrate bypassing of neutral safety switch.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use discarded neutral safety switches and backup light switches to illustrate location, operation, and adjustment features.
2. Demonstrate diagnostic procedures to determine cause of malfunctioning switch.
3. Have students use service manuals to determine location and type of backup light and neutral safety switches for several vehicle makes and models.
4. Have students bypass neutral safety switch on several vehicle makes and models.
5. Have students adjust or replace backup light or neutral safety switch.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, test light, and jumper wire.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.14 **TASK:** Services filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an automatic transmission, tools, equipment and service manuals,

EVALUATION: clean or replace the automatic transmission filter following manufacturer's procedures.

STANDARD: Upon completion, the transmission will not leak fluid.

STUDENT LEARNING EXPERIENCES:

1. Drain and refill ATF.
2. Identify types of filters.
3. Identify types of fluids.
4. Analyze material trapped in filter and pan.
5. Explain the problems that result from using incorrect type of ATF.
6. Use torque wrench.
7. Use technical (service) manuals.
8. Remove and replace pan.
9. Adjust fluid level.
10. Demonstrate procedure for draining ATF from torque converter.
11. Demonstrate procedure for straightening pan bolt hole area.
12. Demonstrate procedure for gasket replacement.
13. Recommend fluid change intervals.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show one or more of the filmstrips listed under Selected Audiovisual Materials.
2. Discuss types of ATF and problems that may result from using incorrect type.
3. Discuss types of foreign matter commonly found in automatic transmissions; collect samples and display them.
4. Demonstrate draining of fluid from transmission and torque converter, replacing screen, and refilling.
5. Discuss factors that determine fluid change intervals.
6. Have students replace a transmission filter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, torque wrench, drain pan, basic hand tool set and transmission filling equipment.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE MANUAL TRANSMISSIONS AND POWER TRAINS. McGraw-Hill Book Co., Novato, CA. 6TH ED. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 26. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 37.7. 1986.

6.0 **COMPETENCY/SKILL:** Maintains and repairs automatic transmission(s).

6.15 **TASK:** Services filter and checks transmission cooling system.

PERFORMANCE OBJECTIVE:

Reference - Competency 6.14

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.1 **TASK:** Performs operational inspections of electrical system(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 7.3

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

7.2 **TASK:** Determines battery state of charge.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a battery, equipment and specifications,

EVALUATION: Determine battery state of charge.

STANDARD: State of charge value (1/4, 1/2, 3/4, or full) must be accurate within + or - 10% of that determined by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Use hydrometer and/or refractometer.
2. Remove and replace caps.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show the filmstrip BATTERY TESTING.
2. Demonstrate the use of hydrometer and refractometer.
3. Discuss effect of temperature on specific gravity and freezing point.
4. Have students match specific gravity readings with state of charge statements.
5. Have students check battery state of charge, load testing and charging a battery.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Battery hydrometer or refractometer and battery filler.

RESOURCES:

AUDIOVISUAL MATERIAL

"Battery Testing." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.2.1 **TASK:** Services or replace batteries, cables, and battery box.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle in need of battery service, tools, equipment, and specifications,
EVALUATION:	service the battery, battery box, and cables and determine the battery state of charge and condition.
STANDARD:	All malfunctions identified by the instructor must be recognized and serviced and the state of charge and serviceability must be identified according to specifications.

STUDENT LEARNING EXPERIENCES:

1. Remove, clean, and replace battery cables.
2. Use battery servicing equipment.
3. Describe safety precautions involved when servicing batteries.
4. Prepare baking soda solution.
5. Adjust electrolyte level.
6. Perform cell-to-cell voltage test.
7. Describe battery construction.
8. Explain sulfation.
9. Activate dry-charged batteries.
10. Define ampere hour.
11. Explain causes of battery failure.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety hazards involved in handling acid, "charging" and "jump" starting.
2. Show one or more of the filmstrips listed under Selected Audiovisual Materials.
3. Discuss causes of battery failure.
4. Use cut-away and components of discarded battery to illustrate construction and sulfation.
5. Discuss battery's internal chemical action during charging and discharging.
6. Discuss temperature effects on battery performance.
7. Review load testing and use of battery charger.
8. Demonstrate activating dry-charged batteries.
9. Demonstrate cell-to-cell voltage test.
10. Use voltmeter on two- or three-volt scale to demonstrate leakage across top of battery.
11. Demonstrate battery cable removal, clamp and post cleaning, and use of baking soda solution.
12. Have students service battery, cable, and box.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, battery charger, battery filler, battery hydrometer or refractometer, baking soda and container, voltmeter and battery components.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 3 and 4. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Paragraphs 3.8-3.15. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 25.4. 1986.

AUDIOVISUAL MATERIAL

"Battery." Gould, Inc., Ed. Systems Div., 4423 Arden Dr., El Monte, CA 91731.

"Battery Servicing." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"Charging System--Battery--Construction and Diagnosis." Ford Motor Co., Training and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 48126.

"Fleet Battery Care and Maintenance Program." Delco-Remy Training Aids, Commercial Service Co., P. O. Box 2499, Anderson, IN 46011.

7.2.2 **TASK:** Load test a battery.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a battery and test equipment,

EVALUATION: perform a load test on a battery.

STANDARD: Test values reported must agree with those determined by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the use of battery capacity testers.
2. Describe safety considerations involved in load testing a battery.
3. Use carbon pile.
4. Use voltmeter and ammeter.
5. Use battery charger.
6. Determine battery ampere hour rating.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety hazards involved in load testing a battery.

2. Demonstrate load testing, using carbon pile and voltmeter.

3. Demonstrate load test (three-minute test), using Battery-Starter-Tester (BST) or Volt-Amp Tester (VAT-40).

4. Have students load test battery and determine state of charge of battery.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Volt-amp Tester (AVR, BST, or VAT-28, VAT-40), battery charger, and battery hydrometer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 3 and 4. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Paragraphs 3.16-3.17. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 26.5. 1986.

AUDIOVISUAL MATERIAL

"Battery Testing." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.3 **TASK:** Locates and repair shorted or open circuits.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a shorted wire or open circuit, tools, test equipment, and service manuals,

EVALUATION: locate and repair the shorted or open circuit.

STANDARD: All shorted or open circuits must be detected and corrected to meet instructor's approval.

STUDENT LEARNING EXPERIENCES:

1. Read and interpret schematic diagrams.
2. Demonstrate the use of a voltmeter, ohmmeter, and ammeter.
3. Demonstrate the use of a test light.
4. Explain function and operation of all electrical components on vehicle.
5. Apply principles of Ohm's Law.
6. Define:

voltage
amperage
resistance
watt
ohm
power
voltage drop
short circuit
open circuit
alternating current
direct current
series circuit
parallel circuit

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss meaning of: volt, ampere, ohm, conductor, insulator, watt, direct current, alternating current, series circuit, parallel circuit, short circuit, open circuit, resistance; ahve students match terms to definitions.

2. Locate and describe function of each component of the electrical system on an automobile.

3. Show one or more of the filmstrips listed under Selected Audiovisual Materials.

4. Have students practice drawing schematic symbols for coil, switch, condenser, diode, transistor, zener diode, potentiometer, resistor, wires crossing, wires connected and lamp.

5. Discuss the theory of operation of ammeters, ohmmeters, and voltmeters.

6. Discuss Ohm's Law in detail; have students solve simple problems involving Ohm's Law.

7. Have students describe change that will occur if one element of Ohm's Law is fixed and another variable.

8. Have students make a number of measurements with a voltmeter, ammeter, and ohmmeter.

9. Have students draw a schematic of a simple circuit, such as a horn or kettering ignition circuit.

10. Have students draw diagram of simple automobile electrical system with battery, one horn, headlights, tail lights, starter, alternator, regulator, ignition switch, and coil; use block representation for components rather than schematic representation.

11. Copy wiring diagram from service manuals; have students identify components and trace current flow.

12. Demonstrate use of test light and voltmeter in tracing circuits and troubleshooting.

13. Make a short circuit by sticking a straight pin through a wiring harness; have students locate and repair a severed wire.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Ammeter, ohmmeter, voltmeter, basic hand tool set, jumper wires, soldering equipment, terminal set and crimping tool, and test light.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 6. 1982.

AUDIOVISUAL MATERIAL

"Basic Electrical Theory and Test Equipment." Gould, Inc., Ed. Systems Div., 4423 Arden Dr., El Monte, CA 91731.

"Electrical Circuit Fundamentals." Ford Motor Co., Training and Publications Dept., 912 Parklane Tower West, Dearborn Michigan 48126.

"Electricity--Diagnosis." Ford Motor Company.

"Introduction to the Automotive Electrical System." Delco-Remy Training Aids, Commercial Service Co., PO Box 2499, Anderson, IN 46011.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.4 **TASK:** Measures resistance in plug wires.

PERFORMANCE OBJECTIVE:

Reference - Competency 7.19

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

7.0 COMPETENCY/SKILL: Maintains and repairs electrical system(s).

7.5 TASK: Analyzes malfunctions in cranking system.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle with a malfunction in the cranking system, tools, test equipment and service manuals,
EVALUATION:	isolate the malfunction and determine the required repair.
STANDARD:	The problem identification and repair must match that recognized by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Describe the function of each component in the starting system.
2. Determine battery state of charge.
3. Read and interpret schematic diagrams.
4. Use test light.
5. Perform voltage drop test.
6. Interpret technical manuals.
7. Test a starter circuit.
8. Locate shorted and open circuits.
9. Explain operation and testing of a relay.
10. Explain the operation of the neutral safety circuit.
11. Diagnose ignition switch malfunctions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on the operation and diagnosis of cranking systems listed under Selected Audiovisual Materials.
2. Have students draw a simple diagram of the wiring and mechanical construction of a solenoid.
3. Have students draw and explain a simple wiring diagram of a neutral safety circuit.
4. Demonstrate a voltage drop test.
5. Demonstrate bypassing of the solenoid and neutral safety switch.
6. Demonstrate load testing of starter.
7. Discuss procedures to diagnose malfunctioning components.
8. Have students diagnose cranking system malfunctions and describe necessary corrective actions.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.
2. Volt-amp Tester (AVR, BST, or VAT-28, VAT-40).
3. Voltmeter.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 27. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 5. 1981.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraph 26.5. 1986.

AUDIOVISUAL MATERIAL

"The Cranking Circuit." Delco-Remy Training Aids, Commerical Service Co., PO Box 2499, Anderson, IN 46011.

"Starting System--Operations and Diagnosis." Ford Motor Co., Training and Publications Dept., 912 Parkland Tower West, Dearborn, MI 48126.

7.6 **TASK:** Repairs starter.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle with a malfunctioning starter, tools, equipment and a service manual,
EVALUATION:	repair the starter to correct the problem.
STANDARD:	The repaired starter must meet manufacturer's performance specifications.

STUDENT LEARNING EXPERIENCES:

1. Interpret service manuals.
2. Use a growler.
3. Describe starter circuitry.
4. Operate an armature lathe.
5. Remove and replace a starter.
6. Disassemble and reassemble starters.
7. Analyze malfunctions in the starter circuitry and drive.
8. Install bushings and brushes.
9. Install starter drive.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss starter failure due to drive, shorts, opens, and defective bearings.

2. Show filmstrip SERVICING THE AUTOMOBILE STARTER.

3. Use various starter drives to illustrate operation and malfunctions.

4. Have students disassemble, test armature and field coils, reassemble, and "benchtest" a classroom starter.

5. Have students turn discarded armatures.

6. Have students remove, repair, and replace a starter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.
2. Growler, armature lathe, ohmmeter/test light.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 27.8 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 6. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 31. 1986.

AUDIOVISUAL MATERIAL

"Servicing the Automobile Starter." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

7.7 **TASK:** Replaces solenoids.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective solenoid, tools, equipment and service manuals,

EVALUATION: replace the solenoid according manufacturer's specifications.

STANDARD: Upon completion, the starting circuit must operate correctly and the ignition switch bypass circuit must be energized during cranking.

STUDENT LEARNING EXPERIENCES:

1. Locate solenoids in various vehicle makes and models.
2. Identify solenoid activating wire and ignition bypass wire.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students locate starter solenoid on several foreign and domestic vehicle makes and models.
2. Have students locate solenoid activating wire and ignition bypass wire on several vehicle makes and models.
3. Have students remove and replace a solenoid in conjunction with task or as a separate task.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Paragraph 4.18. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Paragraphs 26.7, 26.9, and 27.12. 1986.

7.8 **TASK:** Evaluates alternator/generator output.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile, test equipment, tools and instructions,

EVALUATION: determine the generator/alternator output.

STANDARD: Output values must be within + or - 10% of voltage and amperage identified by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Describe the function of each component of the charging system.
2. Describe the operating principles of alternators and generators.
3. Adjust belt tension.
4. Use ammeter, voltmeter, and carbon pile or alternator/generator tester.
5. Use a battery post switch.
6. Interpret technical (service) manuals.
7. Use a tachometer.
8. Describe damage that may result from incorrect test procedures.
9. Demonstrate diagnostic procedures for testing alternators and generators.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use filmstrips/charts to illustrate AC generation and conversion by diodes to direct current.

2. Use a vehicle to locate charging system components; describe the functions of each.

3. Have students draw a simple diagram of the battery, regulator, alternator, and ignition switch wiring.

4. Discuss causes of charging system malfunctions and diagnostic procedures for isolating defective components.

5. Demonstrate "quick check" methods for eliminating (bypassing) regulators on systems with externally or internally mounted solid state regulators.

6. Demonstrate methods for determining current and voltage output.

7. Demonstrate use of Generator-Alternator-Regulator Tester (GART) or equivalent.

8. Have students use appropriate test equipment to obtain voltage and amerage output; compare results to specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.
2. Voltmeter, ammeter, carbon pile or Volt-Amp Tester (AVR, BST, or VAT-28 or VAT-40).

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 29. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 9. 1981.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 29. 1986.

AUDIOVISUAL MATERIAL

"Charging System--Alternator--Principles of Operation." Ford Motor Company, Training and Publications Dept., 912 Parklane Tower West, Dearborn, MI 48126.

"Delcotron Generator and the Charging Circuit." Delco-Remy Training Aids, Commercial Service Co., PO box 2499, Anderson, IN 46011.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.9 **TASK:** Repairs generator/alternator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a defective alternator and generator, tools, equipment, and service manuals,

EVALUATION: repair as needed according to manufacturer's specifications and procedures.

STANDARD: Upon completion, output voltage and amperage must meet manufacturer's performance specifications.

STUDENT LEARNING EXPERIENCES:

1. Assemble and disassembly alternators and generators.
2. Test diodes, stators, and rotors.
3. Use alternator repair tools.
4. Use VAT to make operational test of diodes and stator.
5. Replace bearings.
6. Use alternator tester or equivalent hand-held instruments.
7. Test DC generator(s).

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips on alternator service listed under Selected Audiovisual Materials.
2. Demonstrate testing of diodes, rotor, and stator.
3. Demonstrate inspection, removal, and replacement of bearings.
4. Demonstrate off-car testing of alternator assembly.
5. Demonstrate testing of generator field coils.
6. Demonstrate use of growler.
7. Use classroom alternators/generators t disassemble, test, repair, and reassemble.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, diode tester, diode tool set, gear and bearing pullers, growler, ohmmeter, soldering iron or gun, voltmeter, armature lathe, and alternator service set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 29. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 10. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 29. 1986.

AUDIOVISUAL MATERIAL

"Altnerator--Bearing Replacement and Assembly." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"Alternator--Diode and Stator Testing." Mt. San Jacinto College.

"Alternator--Disassembly and Rotor Testing." Mt. San Jacinto College.

"Servicing the Alternator." Prentice Hall Media, Auto Code 235, 150 White Plains Rd., Tarrytown, NY 10591.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.10 **TASK:** Tests and adjust external-type voltage regulator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a charging system with an external type voltage regulator, tools, test equipment, and service manuals,

EVALUATION: test the regulator and identify any malfunctions. If regulator is vibrating contact type, adjust output to meet manufacturer's standards.

STANDARD: Upon completion, regulator malfunctions identified should match those of the instructor, and the regulator should perform to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain operating principles of vibrating contact and transistorized regulators.
2. Adjust voltage setting.
3. Eliminate regulator by using a jumper wire.
4. Demonstrate voltage regulator testing procedures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use filmstrips/charts to illustrate operation of vibrating contact and solid state regulators.

2. Use discarded vibrating contact regulators to illustrate operation and construction.

3. Discuss procedures used to identify a malfunctioning regulator or alternator.

4. Demonstrate procedures for eliminating (bypassing) solid state and vibrating contact regulators.

5. Demonstrate methods for adjusting output voltage.

6. Have students test and adjust output voltage to meet specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Volt-Amp Tester (AVR, BST, or VAT-28 VAT-40) or voltmeter, ammeter, or carbon pile tester.
2. Jumper wire.
3. Basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 9. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 9. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 29. 1986.

AUDIOVISUAL MATERIAL

"Double Contact Voltage Regulator." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San jacinto, CA 92383.

7.10.1 TASK: Tests internal-type voltage regulator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a charging system with an internal type voltage regulator, tools, test equipment, and service manuals,

EVALUATION: test the internal type voltage regulator.

STANDARD: All malfunctions must be detected to the instructor's satisfaction.

STUDENT LEARNING EXPERIENCES:

1. Explain the operating principles of internal regulators.
2. Evaluate alternator output.
3. Eliminate regulator by bypassing through test hole.
4. Explain how transistorized regulation is accomplished.
5. Explain difference between zener and standard diodes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use chart/filmstrips to describe solid state regulation.
2. Demonstrate on-car testing of internal regulator, using a grounding hole.
3. Have students test regulator to determine if no voltage output or low voltage output is due to alternator or internal regulator.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Voltmeter.
2. Basic hand tool set.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

AUDIOVISUAL MATERIAL

"Ignition Theroy and Wiring." Gould, Inc., Educational Systems Division, 4423 Arden Dr., El Monte, CA 91731.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.11 **TASK:** Evaluates condition of points and condenser of the primary circuit.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a distributor, tools, test equipment and service manuals,

EVALUATION: test the internal type voltage regulator.

STANDARD: All malfunctions must be detected to the instructor's satisfaction.

STUDENT LEARNING EXPERIENCES:

1. Use an ohmmeter and meter with point resistance reading.
2. Interpret tune-up specifications.
3. Describe criteria for rejection of points or condenser.
4. Use "condenser test" function of engine analyzer or distributor tester.
5. Evaluate condenser condition by visually inspecting the points.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students use reference material to determine specific capacity of various condensers.

2. Demonstrate testing of a condenser, using an ohmmeter and a condenser tester.

3. Discuss the effect of incorrect condenser capacity on point condition.

4. Use discarded points to illustrate causes for rejection.

5. Use discarded points to illustrate pitting due to incorrect condenser capacity.

6. Demonstrate measuring points of resistance with dwell meter.

7. Have students evaluate point condition while performing a tuneup.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Screwdriver.
2. Condenser tester.
3. Dwell meter w/points resistance or engine analyzer w/scope or ohmmeter.

RESOURCES:

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapters 13, 14, 15. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.12 **TASK:** Gap spark plugs.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an automobile needing spark plug service, tools, equipment and specifications,

EVALUATION: gap and install spark plugs according to manufacturer's specifications and procedures.

STANDARD: Upon completion, spark plugs must be properly torqued, and wires must be correctly routed and secure.

STUDENT LEARNING EXPERIENCES:

1. Identify types of spark plugs.
2. Use a spark plug cleaner/tester.
3. Interpret specifications.
4. Select correct heat range.
5. Use a torque wrench.
6. Define: reach, heat range, cold plug and hot plug.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip THE SPARK PLUGS.

2. Demonstrate cleaning and electrode filing.

3. Use reference materials and analyze used plug condition to select correct heat range.

4. Discuss problems of under- or over-tightening of plugs.

5. Have students gap at least six spark plugs in conjunction with a tuneup.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Spark plug cleaner/tester.
2. Basic hand tool set.
3. Point file.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraphs 14.4-14.27. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 31. 1986.

AUDIOVISUAL MATERIAL

"The Spark Plugs." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.13 **TASK:** Inspects secondary circuit lead wires, distributor cap, and rotor .

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an assigned vehicle, tools, test equipment, and specifications,

EVALUATION: visually inspect the secondary wires, distributor cap and rotor. Make ohmmeter checks to determine if replacement is necessary to meet specifications.

STANDARD: All defects identified by the instructor must be recognized.

STUDENT LEARNING EXPERIENCES:

1. Identify the secondary circuit parts.
2. Use an ohmmeter.
3. Remove secondary wires.
4. Route secondary wires.
5. Explain use of silicon grease.
6. Explain reason for suppressant (TVRS) wires.
7. State general rule for acceptable secondary wire resistance in ohm/foot.
8. Explain criteria for replacement of cap or rotor.
9. Explain the function of the secondary components.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students identify ignition system secondary wires.
2. Use discarded caps and rotors to illustrate defects that can cause inspection rejection.
3. Discuss reasons for using suppressant wires and the criteria for rejection of them.
4. Discuss complications resulting from incorrect routing of secondary wires.
5. Discuss proper removal of secondary wires to prevent damage and use of silicon grease on wires and rotor.
6. Practice using an ohmmeter on various resistors and discarded secondary wires.
7. Have students inspect secondary wires, cap, and rotor, in conjunction with a tuneup, tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Screwdriver.
2. Ohmmeter.
3. Distributor cleaning brush.

RESOURCES:

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 13, 14, 15. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

AUDIOVISUAL MATERIAL

"The Ignition System Explained." Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

"Ignition System--Principles of Operation." Ford Motor Co. Training and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 58126.

"20,000 Volts Under the Hood." Delco-Remy Training Aids, Commercial Services Co., PO Box 2499, Anderson, IN 46011.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.14 **TASK:** Adjusts ignition timing.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational engine, tools, equipment and service manuals,

EVALUATION: set the ignition timing according to manufacturer's specifications.

STANDARD: Timing must be within + or - 1 degree of manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Use a timing light and a tachometer.
2. Interpret tuneup specifications.
3. State reasons for removing vacuum advance line and obtaining correct RPM.
4. Describe detonation and preignition and give causes of each.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show General Motors movie COMBUSTION IN ACTION.
2. Discuss the combustion processes and the results of over-advance or under-advance ignition.
3. Explain detonation and pre-ignition; use pictures to illustrate consequences of each.
4. Use discarded distributor and vacuum pump to illustrate vaccum advance operation and construction of mechanical advance mechanism.
5. Discuss reasons for having the correct RPM with vacuum line removed when setting timing.
6. Demonstrate the use of a tachometer and timing light.
7. Have students set timing while performing a tuneup.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Timing light, tachometer, distributor hold-down wrench, and vacuum pump.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 14. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 13. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1978.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. Chapter 31. 1986.

AUDIOVISUAL MATERIAL

"Distributors and Timing Procedures." Gould, Inc., Educational Systems Div., 4423 Arden Dr., El Monte, CA 91731.

"How to Use a Portable Tach-Dwell Meter." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

7.15 **TASK:** Replaces points and condenser.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational engine, tools, equipment, iginition points, condenser, and service manual,

EVALUATION: replace the ignition points and condenser according to specifications.

STANDARD: The degree of dwell must be within + or - 1 degree of the specifications, and engine must be timed to within + or - 1 degree of the maufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Adjust ignition timing and dwell.
2. Identify various types of lubricants used on distributor cams.
3. Apply cam lube.
4. Interpret tuneup specifications.
5. Use a tachometer, dwell meter, and timing light.
6. Set dwell while cranking engine.
7. Use feeler gauges.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss relationship between pointgap (dwell) and timing.
2. Discuss reason for using cam lube and the results of using incorrect quantities of it.
3. Demonstrate setting of pointgap (dwell) by cranking engine with dwell meter attached and by using feeler gauge.
4. Use feeler gauge to set pointgap on used points; check results with dwell meter and discuss differences.
5. Have students practice setting dwell while cranking engine.
6. Have students perform a tuneup that requires replacement of ignition points and condenser.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Screwdriver, ignition pliers, dwell meter (or feeler gauge), hex wrench (for GM vehicles), tachometer, and timing light.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 13, 14, 15. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 14. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 30. 1986.

7.0 **COMPETENCY/SKILL:** Maintains and repairs electrical system(s).

7.15.1 **TASK:** Checks advance mechanisms.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational engine, tools, equipment and service manual,

EVALUATION: determine the operation of the distributor advance mechanisms, and if equipment is available, the degrees of total advance, vacuum advance and mechanical advance.

STANDARD: Degrees of advance should be within + or - 2 degrees of those found by the instructor, and all defects must be detected to the instructor's satisfaction.

STUDENT LEARNING EXPERIENCES:

1. Explain the reasons for two advance mechanisms.
2. Explain the effects of inoperable vacuum or mechanical advance mechanisms.
3. Demonstrate testing by "shade tree" methods.
4. Demonstrate testing, using timing light with advance scale.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss reasons for having two ignition advance mechanisms and the effects of their malfunctions.

2. Demonstrate checking of vacuum advance, using tubing and mouth vacuum, and checking of mechanical advance by accelerating engine with vacuum advance removed.

3. Demonstrate using timing ight with advance scale to determine vacuum, total, and mechanical advance.

4. Have students determine total advance and compare with manufacturer's specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Engine analyzer, timing light with advance reading, tachometer, vacuum hose.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 13, 14, 15. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 14. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

Webster, Jay. AUTO MECHANICS, Chapter 30.

7.15.2 **TASK:** Removes, replaces, and adjusts distributor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an engine with distributor, tools and service manuals,

EVALUATION: remove, replace and adjust distributor according to manufacturer's service procedures.

STANDARD: Upon replacement, the engine must be timed to manufacturer's specifications, and the number one cylinder distributor cap tower must be located as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Locate distributor and distributor hold-down clamp.
2. Determine firing order.
3. Determine correct location for number one cylinder coil tower.
4. Statically time engine, using low voltage test light.
5. Insert distributor so that engine is correctly timed for starting.
6. Adjust ignition timing.
7. Determine TDC of number one cylinder.
8. Explain relationship of distributor RPM to cam/crank RPM.
9. Determine the direction of rotation of distributor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss relationship between engine RPM and distributor RPM.
2. Discuss various means for determining direction of rotation of distributor.
3. Demonstrate procedures for determining TDC for the number one cylinder on the compression stroke.
4. Remove distributor, cap, and wires; demonstrate installation procedure and replacement of wires.
5. Demonstrate static timing, using a low voltage test light.
6. Demonstrate installation and timing of electronic (pointless) and conventional distributors.
7. Remove distributor, cap, and wires; crank engine; have students replace distributor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Screwdriver, distributor hold-down bolt wrench, tachometer, timing light, and distributor slide hammer puller.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 13, 14, 15. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 14. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

AUDIOVISUAL MATERIAL

"Distributor." Gould, Inc., Educational Systems Div., 4423 Arden Dr., El Monte, CA 91731.

"Gasoline Engines--Principles of Operation." Ford Motor Co., Training and Publications Dept., 912 Parklane Tower WEst, Dearborn, MI 48126.

7.15.3 **TASK:** Disassembles, repairs, and reassembles distributor.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a non-electronic ignition system distributor, tools, equipment and service manuals,
EVALUATION:	disassemble distributor, inspect all parts, replace those parts not serviceable, reassemble and test unit.
STANDARD:	Upon completion, dwell and mechanical and vacuum advance must be within limits specified by the manufacturer. Shaft to bushing clearance must be within instructor's specified limits.

STUDENT LEARNING EXPERIENCES:

1. Operate a distributor tester.
2. Replace distributor bushings, points and condenser.
3. Remove and replace distributor.
4. Disassemble and reassemble a distributor.
5. Determine serviceability of distributor components.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate the use of a distributor tester.

2. Demonstrate overhaul of a distributor.

3. Have students overhaul a distributor and test on a distributor tester.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Distributor tester, timing light, tachometer.
2. Basic hand tool set, test light, and distributor slide hammer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 13, 14, 15. 1980.

Crouse, William H. AUTOMOTIVE ELECTRICAL EQUIPMENT. McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 14. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 21. 1982.

8.0 COMPETENCY/SKILL: Maintains and repairs fuel system(s).

8.1 TASK: Inspects and replaces air filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a replaceable air filter,

EVALUATION: inspect it for serviceability and replace it if necessary.

STANDARD: Upon completion, the filter housing must be secure, and choke operation should not be affect.

STUDENT LEARNING EXPERIENCES:

1. Explain necessity for air filters.
2. Demonstrate the procedures for servicing a reusable-type air filter.
3. Describe problems associated with defective air filters.
4. Explain effect of air filters on idle speed.
5. Explain volumetric efficiency.
6. Explain problems associated with excessive tightness of wing nut.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the results of obstructed or damaged air filter.

2. Discuss volumetric efficiency and the effect of the air filter on it and on idle speed.

3. Demostrate removal, inpsection, and replacement procedures for air filters.

4. Have students remove, inspect, clean, and replace an air filter.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assorted wrenches, hose clamp pliers, and blowgun.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 14.17. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 22.9. 1986.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.2 **TASK:** Performs operational inspection of fuel system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s), tools and equipment,

EVALUATION: visually check the fuel system for leaks and then perform an operational check of the fuel system.

STANDARD: Any abnormalities will be reported to the instructor.

STUDENT LEARNING EXPERIENCES:

1. Identify components of a fuel system.
2. Diagnose fuel system malfunctions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain the parts of a fuel system.
2. Explain correct fuel system performance.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Operational vehicle, fender covers, and drop light.

RESOURCES:

Remling, John. BASICS. Standard Oil Lubrication Guide.

AUDIOVISUAL MATERIAL

"Basic Fuel Systems". Delco, 35mm filmstrip.

8.3 **TASK:** Measures fuel flow and pressure.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational vehicle, tools, equipment, and service manuals,

EVALUATION: measure the pressure and flow of fuel from the pump.

STANDARD: The measurements taken must match those of the instructor.

STUDENT LEARNING EXPERIENCES:

1. Use a fuel pump pressure tester correctly.
2. Use a graduated cylinder for volume test.
3. Identify the safety hazards involved in testing.
4. Identify factors affecting volume and pressures.
5. Explain operation, advantages, and disadvantages of electric fuel pumps and mechanical fuel pumps.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss operation, construction, advantages, and disadvantages of electrical and mechanical fuel pumps.
2. Have students disassemble classroom fuel pumps, explain the operation, and reassemble.
3. Discuss factors affecting fuel pressure and volume.
4. Discuss precautions involved in testing fuel pumps.
5. Demonstrate volume and pressure test procedures.
6. Have students measure fuel pump pressure and volume, record results, and compare with specifications.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and fuel pump tester.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS, 9TH ED. McGraw-Hill Book Co., Novato, CA. Chapter 14. 1981.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. Chapter 10. 6TH ED. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 22. 1986.

AUDIOVISUAL MATERIALS

"Servicing the Fuel Supply System". Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.4 **TASK:** Repairs or replaces fuel line(s) and hose(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 8.5

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.5 **TASK:** Cleans or replaces fuel filter.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment and service manuals,

EVALUATION: remove, clean (if cleanable type), and install the fuel filter following manufacturer's recommended procedures,

STANDARD: Upon completion, there must be no leaks or stoppages in the fuel system.

STUDENT LEARNING EXPERIENCES:

1. Identify types of fuel filters.
2. Explain the purpose of fuel filters.
3. Determine location of in-line and in-carburetor fuel filters.
4. Determine necessity for cleaning or replacement.
5. Explain the problems associated with restricted fuel flow.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss locationsof fuel filters.
2. Use discarded fuel filters to illustrate various types.
3. Discuss problems resulting from restricted fuel filters or absence of filters.
4. Demonstrate diagnostic procedures to detect restricted fuel filters.
5. Have students remove and replace or clean gasoline filter in conjunction with tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Line wrenches, screwdriver, and hose clamp pliers.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS, McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 12. 1981.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 11. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 22. 1986.

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8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.6 **TASK:** Inspects, cleans, and adjusts choke unit (automatic and manual).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given vehicles with manual and automatic chokes, tools, equipment and specifications,

EVALUATION: inspect, clean and adjust the chokes as specified by the manufacturer.

STANDARD: Upon completion, the choke settings must be as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Explain the operation and adjustment of a well-type (Sisson) automatic choke.
2. Explain the operation and adjustment of carburetor-mounted (bi-metal spring) type automatic choke.
3. Demonstrate the cleaning and adjustment of automatic and manual chokes.
4. Explain the methods of cooling automatic chokes to adjustment temperature.
5. Explain problems of over- or under-choking.
6. Explain the function and operation of the unloader.
7. Explain the resons for and operation of electric choke assists.
8. Demonstrate procedure for starting a flooded engine.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss choke operation and problems resulting from over- or under-choking.
2. Use a classroom carburetor to illustrate function and operation of unloader.
3. Use several typesof classroom carburetors to illustrate operation and components of manual and automatic chokes.
4. Demonstrate cooling and adjusting an automatic choke.
5. Have students adjust a manual and an automatic choke.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assorted screwdrivers and wrenches, solvents, and pin gauge set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS, McGraw-Hill Book Co., Novato, CA. 9TH ED. Chapter 14. 1981.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 11. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 21. 1986.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.7 **TASK:** Overhaul 1-, 2-, or 4-barrel carburetor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning carburetor, tools, equipment, service manuals and a carburetor overhaul kit,

EVALUATION: diagnose the problem and overhaul the carburetor using an overhaul kit.

STANDARD: Upon completion all adjustments must conform to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Remove, replace, and adjust a carburetor.
2. Identify and explain the function of all six carburetor systems.
3. Define: carburetor, atomization, venturi, perculation, economizer, hesistation, metering, volatility, vacuum, vaporization, vapor lock, octane rating, and airhorn.
4. Demonstrate the steps in carburetor overhaul.
5. Use a tachometer.
6. Follow necessary adjustments to all carburetor systems.
7. Make necessary adjustments to all carburetor systems.
8. Explain causes of and cures for vapor lock.
9. Explain operation of secondary systems.
10. Explain venturi action.
11. Explain problems associated with an excessively high or low float level.

12. Explain problems associated with defects in accelerator pump circuit.

13. Explain problems associated with the full power circuit.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the composition of gasoline and the meaning of related terms.

2. Have students match carburetor terms and definitions.

3. Use filmstrips to describe function, operation, and adjustment of each carburetor system.

4. Have students disassemble classroom carburetors and overhaul instructions to disassemble, make all adjustments, and reassemble.

5. Have students use classroom carburetors and overhaul instructions to disassemble, make all adjustments, and reassemble.

6. Discuss symptoms of carburetor malfunctions and diagnostic method for each.

7. Demonstrate carburetor overhaul.

8. Have students overhaul a carburetor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Carburetor gauge set, tachometer, carburetor cleaner, basic hand tool set, blowgun.

RESOURCES:

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapters 6 and 12. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 20. 1986.

AUDIOVISUAL MATERIAL

"Carburetion Theory." Gould, Inc., Educational Systems Div., 4423 Arden Dr., El Monte, CA 91731.

"Carburetor Circuits and Adjustments." Carter Educational Aids, PO Box 16092, Clayton, MO 63105.

"Carburetor Ooverhaul." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"Fuel System and Carburetion." Ford Motor Company, Training and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 48126.

"How to Overhaul a Carburetor." Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.8 **TASK:** Analyzes for moisture or foreign particles in fuel system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools and equipment,

EVALUATION: remove the carburetor bowl cover and inspect the carburetor for dirt, sediment, and moisture. If foreign particles exist, clean the carburetor as recommended by the manufacturer.

STANDARD: All foreign material must be removed from the float bowl according to manufactuer's recommendations. Float level must be correct to + or - 1/32".

STUDENT LEARNING EXPERIENCES:

1. Clean or replace fuel filter and adjust the carburetor.
2. Recognize moisture, foreign particles, dirt, and sediment in carburetor.
3. Adjust the carburetor float level.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate the removal of bowl covers on several models of carburetors.
2. Collect sediment and debris from overhauled carburetors; use material to illustrate types of debris.
3. Have students use classroom carburetors to practice setting float level.
4. Have students inspect bowl for foreign material.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Line wrench set, assorted screwdrivers and wrenches, blowgun, and solvent.

RESOURCES:

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8.0 COMPETENCY/SKILL: Maintains and repairs fuel system(s).

8.9 TASK: Removes and replaces carburetor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: remove and replace the carburetor following manufacturer's procedures.

STANDARD: Idle speed must be within + or - 50 RPM of manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Use tachometer, and line wrenches.
2. Interpret specifications.
3. Adjust carburetor.
4. Correctly install base gasket, vacuum hoses, and linkage.
5. Interpret vacuum hose diagrams.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate how line wrenches minimize damage to fittings.
2. Discuss the results of incorrect installation of base gasket and hoses on engine performance.
3. Demonstrate carburetor removal and replacement.
4. Have students remove and replace carburetor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Line wrench set, basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. Chapter 14. 8TH ED. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 12. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 22. 1978.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 20. 1986.

AUDIOVISUAL MATERIAL

"Carburetor Removal, Cleaning and Replacement". Gould Inc., Educational Systems Div., 4423 Arden Dr., El Monte, CA 91731.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.10 **TASK:** Diagnoses and repairs fuel system malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operable engine with a fuel system malfunction, tools, equipment, and service data,

EVALUATION: diagnose the problem and make necessary repairs.

STANDARD: Upon completion, the fuel system must operate according to manufacturer's standards.

STUDENT LEARNING EXPERIENCES:

1. Measure fuel volume and pressure.
2. Overhaul carburetor.
3. Replace fuel pump.
4. Clean/replace fuel filter.
5. Service/repair heat risers.
6. Inspect/replace air filters.
7. Remove, clean, and replace gas tank.
8. Clean fuel lines.
9. Use service data.
10. Clean and adjust choke.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review carburetor systems and operation.
2. Discuss fuel system diagnostic procedures.
3. Discuss gas tank removal and cleaning.
4. Demonstrate fuel line cleaning.
5. Have students diagnose and repair a fuel system malfunction.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vacuum gauge, carburetor gauge set, pressure and volume tester, basic hand tool set, solvents and blowgun.

RESOURCES:

Manufacturer's service manuals.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.10 **TASK:** Diagnoses and repairs fuel system malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operable engine with a fuel system malfunction, tools, equipment, and service data,

EVALUATION: diagnose the problem and make necessary repairs.

STANDARD: Upon completion, the fuel system must operate according to manufacturer's standards.

STUDENT LEARNING EXPERIENCES:

1. Measure fuel volume and pressure.
2. Overhaul carburetor.
3. Replace fuel pump.
4. Clean/replace fuel filter.
5. Service/repair heat risers.
6. Inspect/replace air filters.
7. Remove, clean, and replace gas tank.
8. Clean fuel lines.
9. Use service data.
10. Clean and adjust choke.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review carburetor systems and operation.
2. Discuss fuel system diagnostic procedures.
3. Discuss gas tank removal and cleaning.
4. Demonstrate fuel line cleaning.
5. Have students diagnose and repair a fuel system malfunction.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vacuum gauge, carburetor gauge set, pressure and volume tester, basic hand tool set, solvents and blowgun.

RESOURCES:

Manufacturer's service manuals.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.11 **TASK:** Adjusts carburetor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: adjust the carburetor idle speeds to manufacturer's specifications by following the recommended procedure.

STANDARD: Curb idle, fast idle, and solenoid disconnect idle must be set within + or - 50 RPM of the manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify and locate carburetor adjusting screws.
2. Explain function and operation of fast idle cam.
3. Explain function and operation of anti-diesel solenoid.
4. Explain function and operation of automatic choke.
5. Use a tachometer.
6. Interpret specifications.
7. Explain adjustment of idle speed by propane enrichment.
8. Explain idle problems associated with vacuum leaks and defective PCV valves.
9. Adjust the idle mixture, using a vacuum gauge.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use classroom carburetors to illustrate air screws, throttle stop screws, fast idle cams, anti-diesel solenoids, and automatic chokes.
2. Demonstrate the use of propane enrichment in setting idle speeds.
3. Use a live engine to demonstrate effect of a plugged PCV valve or one stuck in the open position.
4. Use vacuum gauge to illustrate the relationship between idle mixture and manifold vacuum.
5. Have students look up idle specifications and set idle on several makes and models of carburetors.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Tachometer, vacuum gauge, assorted screwdrivers and wrenches.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. Chapter 14. 8TH ED. Chapter 13. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapters 6 and 12. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 21. 1986.

AUDIOVISUAL MATERIALS

"Factors Affecting Curb Idle Adjustments". Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.12 **TASK:** Removes and replaces fuel pump.

PERFORMANCE OBJECTIVE:

EVALUATION: remove and replace the fuel pump following manufacturer's recommended procedures.

STANDARD: After installation fuel line connections must not leak and engine must be operable.

STUDENT LEARNING EXPERIENCES:

1. Identify types of fuel pumps.
2. Determine location of fuel pumps (electrical and mechanical).
3. Use line wrenches.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review measuring fuel flow and pressure.
2. Discuss location of electrical and mechanical pumps.
3. Demonstrate fuel pump removal and replacement procedures.
4. Have students replace a fuel pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. Chapter 14. 8TH ED. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 11. 1981.

8.0 **COMPETENCY/SKILL:** Maintains and repair fuel system(s).

8.13 **TASK:** Tests gas tank sending unit.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a faulty sending unit, tools, equipment and service manuals,

EVALUATION: test the fuel tank sending unit following manufacturer's recommended procedures.

STANDARD: A statement on the units serviceability must be made and explained.

STUDENT LEARNING EXPERIENCES:

1. Locate and repair shorted and open circuits.
2. Locate and remove the gas tank sending unit.
3. Identify positive and negative connections.
4. Explain causes for incorrect gauge readings.
5. Describe the operation of balancing coil and thermostatic-type gauges.
6. Test dash units.
7. Explain operation of Instrument Voltage Regulator (IVR).
8. Use an ohmmeter.
9. Demonstrate test procedures, using substitute sending unit.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review procedure for locating shorts or opens.
2. Review gauges.
3. Use a discarded gasoline sending unit to illustrate operation.
4. Use an ohmmeter and a substitute sending unit to demonstrate testing the operation of the sending unit.
5. Have students test gauge/sending unit operation by substitution.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Voltmeter, test light, jumper wire.
2. Serviceable sending unit or rheostat.

RESOURCES:

Crouse, William H., and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS, McGraw-Hill Book Co., Novato, CA. 6TH ED. Chapter 11. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20. 1982.

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.14 **TASK:** Performs operational inspections of exhaust emission control system.

PERFORMANCE OBJECTIVE:

Reference - Competencies 4.28, 4.30

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.15 **TASK:** Repairs or services exhaust emission control system.

PERFORMANCE OBJECTIVE:

Reference - Competencies 4.28,

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.16 **TASK:** Services or repairs manifold heat controls (heat risers).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a manifold heat control (heat riser), tools and equipment,

EVALUATION: inspect the operation of the control and service as necessary.

STANDARD: Upon completion, the heat riser valve must be free to move and must move to a closed position when cold.

STUDENT LEARNING EXPERIENCES:

1. Explain the function and operation of a heat riser.
2. Explain problems associated with a heat riser stuck in the open or closed position.
3. Select correct lubricant to lubricate heat riser.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the reason for having heat rishers and the diagnostic procedures for and problems resulting from their malfunctions.
2. Discuss lubricants used in servicing.
3. Demonstrate manifold heat control servicing procedures.
4. Have students "free up" and lubricate a heat riser.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vacuum gauge, 8 oz. hammer, solvent and vacuum pump.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 13.26. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraphs 5.28 and 5.29. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 20 and 23. 1982.

8.17 **TASK:** Repairs or replaces fuel injector.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle(s) with a fuel injection system, tools, and equipment,

EVALUATION: Remove and replace a fuel injection nozzle(s).

STANDARD: Upon completion, there will be no fuel leaks and fuel injection system shall be operational.

STUDENT LEARNING EXPERIENCES:

1. Identify components of a fuel injector system.
2. Demonstrate removal and replacement of a fuel injector.
3. Discuss causes for injector failure.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain fuel injection system.
2. Explain causes for injector failure.
3. Demonstrate removal and replacement of a fuel injector nozzle.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, and service manuals.
2. Flare nut wrench set, clean shop rags, and O-rings.

RESOURCES:

Fuel injection manual
Factory service manuals

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.18 **TASK:** Repairs or replaces fuel injector.

PERFORMANCE OBJECTIVE:

Reference - Competencies 4.12,

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.19 **TASK:** Replaces electrical fuel injection computer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a faulty fuel injection computer, tools and service manuals,

EVALUATION: remove battery cables, remove and replace fuel injection computer, reconnect battery cables and check system operation.

STANDARD: Upon completion, fuel injection system must be operational.

STUDENT LEARNING EXPERIENCES:

1. Discuss causes for fuel computer failure.
2. Demonstrate removal and replacement of fuel injection computer.
3. Demonstrate operational test of fuel injection system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain causes for fuel computer failure.
2. Demonstrate removal and replacment of computer.
3. Demonstrate operational test of fuel injection system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, and factory service manuals.

RESOURCES:

Factory service manuals

8.20 **TASK:** Reads vacuum schematic(s).

PERFORMANCE OBJECTIVE:

Reference - Competencies 13.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.21 **TASK:** Service or replaces units in a vacuum system.

PERFORMANCE OBJECTIVE:

Reference - Competencies 13.13

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

8.0 **COMPETENCY/SKILL:** Maintains and repairs fuel system(s).

8.22 **TASK:** Services or repairs turbocharger.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a turbocharger, tools, equipment and service manuals,

EVALUATION: make all clearance measurements and repair as needed.

STANDARD: All clearances should be within manufacturer's specified tolerances unless otherwise noted.

STUDENT LEARNING EXPERIENCES:

1. Discuss turbocharger failure.
2. Read a micrometer.
3. Read a dial indicator.
4. Demonstrate bushing removal and replacement in a turbo.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain reasons for turbo failure.
2. Demonstrate how to read a micrometer.
3. Demonstrate how to read a dial indicator.
4. Explain reasons for close tolerances in turbo.
5. Demonstrate re-bushing a turbocharger.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. 0-1" micrometer, basic hand tool set, turbocharger unit.
2. Dial indicator, bushing driver set, and service manuals.

RESOURCES:

Factory service manuals

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.1 **TASK:** Static balance a tire and wheel assembly.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tire and wheel assembly, tools, equipment and service manuals,

EVALUATION: static balance a tire and wheel assembly according to industry procedures.

STANDARD: Upon completion, bubble must be exactly centered.

STUDENT LEARNING EXPERIENCES:

1. Remove and replace wheel.
2. Use wheel weight pliers and wheel weights.
3. Use a static balancing machine.
4. Define "static balance" and "dynamic balance".
5. Explain limitations of static balancing.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss meaning of "static" and "dynamic" wheel balancing.
2. Discuss advantages and disadvantages of static (bubble) balancing.
3. Demonstrate static balancing.
4. Have students static balance several wheels.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Bubble balancer, wheel weight tool, floor jack and jack stands.
2. Lug wrench or impact wrench set, and hub cap remover/replacer.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 6, part 1. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 54.20. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 30. 1982.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.1.1 **TASK:** Spin balance on-the-car tire and wheel.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a properly mounted road wheel, tire, tools, equipment and service manuals,

EVALUATION: spin (dynamic) balance the road wheel and tire according to manufacturer's procedures.

STANDARD: Upon completion, there must be no detectable vibration when wheel is spun at cruising speed and permitted to coast to a stop.

STUDENT LEARNING EXPERIENCES:

1. Use dynamic balancing machine.
2. Define "dynamic balance".
3. Demonstrate safety precautions to be observed when spin balancing a wheel.
4. Use wheel weight pliers and weights.
5. Judge RPM of wheel at cruising speed.
6. Demonstrate precautions and procedures for balancing rear wheel with limited slip differential.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss advantages and disadvantages of dynamic on-car balancing.
2. Use a vehicle with front wheel speedometer cable to have students spin wheel to cruising speeds.
3. Demonstrate on-car balancing.
4. Have students balance several front and rear wheels on the car.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Floor jack, on-car balancer, wheel weight tool and wheel weights.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 6, Part 1. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 54.20. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 30. 1982.

AUDIOVISUAL MATERIAL

"How to Balance Wheels." Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

"On-The-Car Wheel Balance." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.1.2 **TASK:** Computer balance tire and wheel (off-the-car).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a tire and wheel assembly, tools, equipment and service manuals,

EVALUATION: balance a tire and wheel assembly according to procedures for computer or other off-car balancer.

STANDARD: Tire and wheel assembly must be balanced within 1/4 ounce of dynamic balance.

STUDENT LEARNING EXPERIENCES:

1. Describe safety hazards.
2. Use computer or other off-car balancer.
3. Remove and replace wheels.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss advantages and disadvantages of off-car spin balancing compared with on-car balancing and bubble balancing.
2. Demonstrate off-car spin balancing procedures.
3. Have students balance several wheels.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Off-car balancer, floor jack and jack stand.
2. Hub cap remover/replacer, impact wrench, 1/2" drive, w/sockets or lug wrench and wheel weight tool.

RESOURCES:

Manufacturer's instruction manuals.

AUDIOVISUAL MATERIAL

Off The-Car Wheel Balance". Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.2 **TASK:** Inspects, repacks, and adjusts front wheel bearings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: remove, clean, inspect, repack, replace and adjust inner and out front wheel bearings.

STANDARD: Upon completion, wheel bearing adjustment must be as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Use seal and bearing removal and/or installation tools.
2. Determine the serviceability of front wheel seals.
3. Explain how wheel bearing grease differs from chassis grease.
4. Use a torque wrench and a cotter pin puller.
5. Remove and replace calipers.
6. Preload bearings.
7. Demonstrate cleaning and repacking procedures.
8. Explain causes for and symptoms of wheel bearing failure.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss causes and symptoms of wheel bearing failures; use discarded bearings to illustrate types of fialures.
2. Use defective bearings to illustrate types of defects.
3. Discuss characteristics and composition of various types of grease.
4. Discuss shim-type front wheel bearing adjustment.
5. Demonstrate removal, inspection, and replacement of front wheel seals.
6. Demonstrate removing, cleaning, repacking, and replacing front wheel bearing and bearing race.
7. Have students clean, pack, and adjust wheel bearings, in conjunction with a brake job.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, wheel bearing grease, and torque wrench.
2. Bearing an seal removal and installation tool, floor jack and jack stands.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 30. 1982.

Manufacturer's service manuals.

AUDIOVISUAL MATERIAL

"Repacking Front Wheel Bearings". Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.3 **TASK:** Replaces belts and sets tension.

PERFORMANCE OBJECTIVE:

Reference - Competency 1.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.4 **TASK:** Inspects and replaces steering spindle.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.7

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.5 **TASK:** Replaces manual steering gear components.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a malfunctioning manual steering gear, replacement parts, tools, equipment, and service manuals,

EVALUATION: overhaul the manual steering gear according to manufacturer's specifications and procedures.

STANDARD: Upon completion, steering gear must not bind or have excessive free play.

STUDENT LEARNING EXPERIENCES:

1. Adjust steering backlash.
2. Demonstrate use of specialized tools for overhauling a manual steering gear.
3. Explain the operation and adjustment of both power and non-power manual steering gears.
4. Describe the symptoms that characterize steering gear defects.
5. Interpret service procedures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss symptoms of defective steering gear components.

2. List suspension defects, including steering gear defects; have students match defects to a list of symptoms.

3. Have students disassemble, inspect, adjust, and reassemble a manual and power steering "box".

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, assorted pullers.
2. Assorted seal remover/installers, and lubricant dispenser.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 5, Part 1. 1974.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.6 **TASK:** Removes and replaces tie rod ends.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, replacement parts, tools, equipment, and a service manual,

EVALUATION: remove and replace a tie rod end according to manufacturer's procedures and specifications.

STANDARD: Upon completion, tie rod end must be securely fastened, toe-in must be correct and sterring wheel straight.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the techniques to determine if a tie rod end needs to be replaced.
2. Demonstrate use of tie rod end separator.
3. Determine correct tie rod length and replace it.
4. Describe situations in which the rod ends have to toe-in and/or toe-out.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate procedure for inspecting tie rod ends for serviceability.
2. Have students remove tie rod end, replace it, and set toe.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, assorted hand jacks, and jack stands.
2. Tie rod end remover.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 54. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.7 **TASK:** Repairs upper and lower control arm assemblies (bushings and ball joints).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, replacement parts and service manuals,

EVALUATION: remove upper and lower control arm assemblies. Install new bushings and ball joints in the upper and lower control arms and replace the assemblies according to manufacturer's procedures and specifications.

STANDARD: Upon completion, both control arms and assemblies should be secure and should meet manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Remove and replace shock absorber.
2. Demonstrate the correct methods for coil spring removal.
3. Demonstrate the correct use of bushing removal and installation tools.
4. Demonstrate the correct use of ball joint removal and installation tools.
5. Describe safety hazards involved.
6. Explain symptoms of worn parts in upper and lower control arms.
7. Inspect front suspension.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the types of defects and symptoms that may occur in control arms.

2. Discuss and demonstrate diagnostic procedures used to detect defective parts.

3. Discuss safety hazards involved in removal and replacement of coil springs.

4. Have students remove control arm, replace bushings and ball joint, and replace arm.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Coil spring compressor, ball joint press, tie rod end separator, vehicle lift, and basic hand tool set.
2. Air impact wrenches, assorted hand jacks, hydraulic press and jack stands.

RESOURCES:

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 43. 1986.

AUDIOVISUAL MATERIAL

"Lower Load-Carrying Ball Joints: Inspection and Replacement". Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

"Upper Load-Carrying Ball Joints: Inspection and Replacement". Prentice Hall Media.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.8 **TASK:** Repairs or replaces power steering pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning power steering pump, replacement parts, tools, equipment and service manuals,

EVALUATION: remove and replace faulty pump assembly. Tighten drive belt and bleed system to restore vehicle to perating condition.

STANDARD: Upon completion, system must have no leaks or abnormal noises.

STUDENT LEARNING EXPERIENCES:

1. Remove faulty pump.
2. Exchange brackets as necessary.
3. Reinstall pump.
4. Adjust drive belt tension.
5. Connect hoses and refill reservoir.
6. Bleed system and refill as needed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain power steering pump failures.
2. Demonstrate proper procedure for pump replacement, belt adjustment and system bleeding.
3. Explain cause of abnormal noises and leaks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and flare nut wrenches.
2. Belt tension gauge and floor jack and jack stands.

RESOURCES:

Remling, John. STEERING AND SUSPENSION. John Wiley and Sons, NY. Chapter 15. 19__.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.8.1 **TASK:** Repairs or replaces power steering pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning power steering pump, replacement parts, tools, equipment and service manuals,

EVALUATION: remove faulty pump from vehicle, clean and repair pump as necessary, replace pump, and restore to operation.

STANDARD: Upon completion, system must have no leaks or abnormal noises.

STUDENT LEARNING EXPERIENCES:

1. Evaluate and explain reason(s) for pump failure.
2. Remove pump and clean pump housing.
3. Remove pump pulley.
4. Clean and replace pump seal(s) and gaskets.
5. Reassemble pump.
6. Replace rebuilt pump on vehicle.
7. Bleed and adjust as necessary.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain power steering pump failure(s).

2. Explain causes of abnormal noises and leaks from power steering pumps.

3. Demonstrate proper procedure for pump replacement, belt adjustment and system bleeding.

4. Demonstrate pump repair procedures.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, flare nut wrench set, P/S pulley puller.
2. Floor jack and jack stands, arbor press, and clean solvent.

RESOURCES:

Crouse, William H., and Donald L. Anglin. AUTOMOTIVE BODY REPAIR AND REFINISHING. McGraw-Hill Book Co., Novato, CA. 2ND ED. Chapters 10-13. 1986.

Remling, John. STEERING AND SUSPENSION, John Wiley and Sons, NY Chapter 15. 19__.

Manufacturer's service manuals.

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.9 **TASK:** Repairs or replaces power steering components.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.5

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.10 **TASK:** Rebuilds power steering cylinder.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.5

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

9.0 **COMPETENCY/SKILL:** Maintains and repairs standard and power steering units.

9.11 **TASK:** Adjusts steering backlash.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle with an adjustable manual steering gear, tools, equipment and service manuals,
EVALUATION:	adjust the steering gear backlash according to manufacturer's specifications and procedures.
STANDARD:	After adjustment steering gear must not bind and backlash must be within specified limits.

STUDENT LEARNING EXPERIENCES:

1. Use correctly the specialized tools required to adjust steering gear backlash.
2. Demonstrate the procedure for determining backlash.
3. Explain the operation of steering gears and how adjustments on them are made.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss inspection and adjustment procedures.
2. Have students disassemble, adjust, and reassemble discarded steering "boxes".
3. Have students adjust backlash on an operational vehicle.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, torque wrench, and spring scale.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 54. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 45.7. 1986.

10.0 COMPETENCY/SKILL: Maintains and repairs braking system(s).

10.1 TASK: Adjusts brake shoes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: adjust brake shoes following vehicle manufacturer's specifications.

STANDARD: The adjustment must be free of drag and must conform to manufacturer's standards.

STUDENT LEARNING EXPERIENCES:

1. Remove wheel and drums.
2. Use adjusting tools.
3. Release self adjusters to "back off".
4. Explain operation of various adjustment mechanisms (self and manual adjusters).
5. Use drum-to-shoe gauge.
6. Diagnose malfunctions of self-adjusting mechanisms.
7. Repack and adjust front wheel bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss conditions that require removal and replacement of drums; demonstrate removal and replacement.
2. Remove drums from a vehicle and show self adjuster, adjusting mechanisms, and defects that may prevent normal adjustment.
3. Discuss problems that may prevent proper adjustment.
4. Demonstrate use of brake shoe gauge.
5. Demonstrate adjusting of brakes.
6. Have students adjust brake shoes in conjunction with a brake drum job.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, brake adjusting tools, brake drum puller, wheel removing tools and brake drum gauge.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Remling, John. BRAKES. John Wiley and Sons, NY. 2nd edition. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 46. 1986.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.2 **TASK:** Adjusts hand brake linkage

PERFORMANCE OBJECTIVE:

Reference - Competency 10.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.3 **TASK:** Adjusts hand brake external band.

PERFORMANCE OBJECTIVE:

Reference - Competency 10.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.4 **TASK:** Bleeds hydraulic brakes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with hydraulic brakes, tools, equipment and service manuals,

EVALUATION: bleed the hydraulic brake system to expel air according to manufacturer's procedures.

STANDARD: Upon completion, brake pedal must be firm with no sponginess, brake warning light must be off, and brake fluid level must be correct to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain the operation and use of bleeder tanks.
2. Describe the order in which wheels should be bled.
3. Demonstrate procedure for bleeding without bleeder tank.
4. Diagnose presence of air in hydraulic system.
5. Adjust fluid level in master cylinder.
6. Recenter warning light acutator.
7. Identify problems caused by air in the hydraulic system.
8. Identify reasons for air entering hydraulic system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students list possible reasons for and problems associated with air entering hydraulic system.
2. Discuss construction and operation of brake light warning actuator.
3. Demonstrate recentering of brake light warning actuator.
4. Demonstrate bleeding with and without pressure bleeder.
5. Introduce air into hydraulic system; have students apply brakes to identify a "spongy" pedal.
6. Have students bleed brakes in conjunctin with a wheel cylinder overhaul, or a master cylinder overhaul.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Brake fluid dispenser or brake pressure bleeder.
2. Vehicle lift or floor jack and jack stand.
3. Brake bleeder wrench.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapters 1-3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapters 46 and 47. 1986.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.5 **TASK:** Free up parking brake cables.

PERFORMANCE OBJECTIVE:

Reference - Competency 10.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.6 **TASK:** Inspects and replaces brake pads.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle with disc brakes, tools, equipment and service manuals,
EVALUATION:	inspect the brake pads for thickness and replace pads according to manufacturer's procedures and specifications.
STANDARD:	Upon completion, vehicle must not pull to one side during brake application, fluid level must be correct to manufacturer's specifications, and there must be no unusual noises.

STUDENT LEARNING EXPERIENCES:

1. State brake pad wear limits.
2. Adjust brake fluid level.
3. Demonstrate procedure for removal and replacement of calipers.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss criteria for replacement.

2. Demonstrate removal and replacement of pads.

3. Have students inspect and replace disc brake pads.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Floor jack (or lift), basic hand tool set.
2. Pressure brake bleeder or fluid dispenser, "C" clamp (6" or 8"), and jack stands.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 4, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 56.30. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapters 46 and 47. 1986.

10.7 **TASK:** Checks disc runout and thickness.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with disc brakes, tools, equipment and service manuals,

EVALUATION: check the disc runout and thickness according to manufacturer's procedures and specifications.

STANDARD: Indicator and micrometer readings obtained must be the same as the instructors and serviceability must be correctly stated.

STUDENT LEARNING EXPERIENCES:

1. State various manufacturer's limits for rotor runout and thickness.
2. Interpret specifications.
3. Use dial indicator and outside micrometer.
4. Adjust front wheel bearings.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss wear and runout limits.
2. Have students use service manuals to determine minimum permissible thickness.
3. Demonstrate use of micrometer and dial indicator to measure runout and wear; have students practice using equipment.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Micrometer, dial indicator, impact wrench and sockets.
2. Hub cap remover/replacer, and wheel bearing adjusting tools.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 56.30. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 47.22 1986.

AUDIOVISUAL MATERIAL

"Disc Brake Rotor Service". Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.7.1 **TASK:** Reconditions disc brake and rotors.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with disc brakes, gauges, micrometers, tools, equipment and service manuals,

EVALUATION: inspect and refinish the rotor, following manufacturer's procedures and specifications.

STANDARD: Upon completion, the rotor must meet manufacturer's specifications for permissible runout, thickness and finish.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the operation of disc brake lathe.
2. Check disc runout and thickness.
3. Use outside micrometer and dial indicator.
4. Remove and replace calipers.
5. Adjust wheel bearings.
6. State limits for runout, thickness variations, wear, scoring, and pitting.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss rotor defects and criteria for rejection or resurfacing of rotors.
2. Demonstrate use of brake lathe.
3. Demonstrate use of micrometer and dial indicator to determine serviceability.
4. Have students check a variety of vehicles for disc runout, wear, and thickness variation.
5. Demonstrate removal and replacement of rotors.
6. Obtain a variety of discarded rotors; have student practice reconditioning on brake lathe.
7. Have students, in conjunction with a disc brake job, recondition a rotor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Micrometer, dial indicator.
2. Brake drum and disc lathe, basic hand tool set, and "C" clamp (6" or 8").

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 47. 1986.

AUDIOVISUAL MATERIAL

"Disc Brake Rotor Service". Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"How to Use a Drum Lathe". Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

10.8 **TASK:** Inspects brake drum(s).

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a set of brake drums, brake micrometers, equipment, and service manuals,
EVALUATION:	Inspect the brake drums following manufacturer's procedures and specifications.
STANDARD:	All defects must be identified, and diameter must be determined to within + or - 0.005".

STUDENT LEARNING EXPERIENCES:

1. Use brake micrometer.
2. Interpret specifications.
3. Explain causes of: hot spots, scoring, bell-mouthing, out-of-round.
4. State general rule for rejection due to oversize.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Collect discarded brake drums with various defects and discuss causes for the defects.

2. Discuss limits on wear or turning and problems resulting from oversize.

3. Demonstrate inspection for oversize.

4. Have students remove and inspect brake drums in conjunction with a brake job.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Channell locks, assorted hand jacks, jack stands, air impact wrenches, and assorted brake adjusting tools.
2. Brake drum puller, brake drum micrometer, side cutting pliers (Dykes), and hub cap remover/replacer.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapters 46 and 47. 1986.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.8.1 **TASK:** Reconditions brake drums.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a set of brake drums, micrometers, equipment and service manuals,

EVALUATION: refinish the brake drums following manufacturer's procedures and specifications.

STANDARD: Upon completion, drum must meet manufacturer's specifications for finish, roundness, and bell-mouthing.

STUDENT LEARNING EXPERIENCES:

1. State turning limits specified by manufacturer.
2. Operate brake drum lathe.
3. Remove and replace drums, and adjust brake shoes.
4. Identify reasons for turning brake drums on both sides of vehicle, even if only one needs reconditioning.
5. Use brake micrometer and brake shoe gauge.
6. Explain causes of bell-mouthing, out-of-round, hot spots, scoring, etc.
7. Adjust fluid level.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss typical brake drum defects and the causes and symptoms of each.

2. Review preceding instruction on wear limits, inspection, removal and replacement.

3. Show filmstrips listed under Audiovisual Material.

4. Obtain samples of defective brake drums; have students identify the defects and their causes.

5. Demonstrate use of brake drum lathe.

6. Obtain discarded drums and have students practice turning them.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Brake drum micrometer and brake drum and disc lathe.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 47.17. 1986.

AUDIOVISUAL MATERIAL

"Drum Lathe Operation". Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"How to Use a Drum Lath". Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.9 **TASK:** Inspects, repairs or replaces self adjustor(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 10.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.10 **TASK:** Diagnoses malfunction of drum or disc braking system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: test the service braking system according to manufacturer's procedures and tolerances.

STANDARD: All malfunctions must be identified.

STUDENT LEARNING EXPERIENCES:

1. Explain the causes of and demonstrate diagnositic procedures for detecting the following problems:

   pull to one side
   pulsating pedal
   spongy pedal
   low pedal (excessive pedal travel)
   brake warning light remaining on
   excessive wear, noises, etc.
   grinding
   dragging brakes
   pedal fade away
   hard pedal

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show one or more filmstrips on operation and diagnosis of hydraulic brake systems listed under Audiovisual Material.
2. Discuss typical brake system defects and the cause and diagnostic procedures for each.
3. Have students match a list of defects to their possible causes and corrections.
4. Describe function and testing of metering valve and proportioning valve.
5. Demonstrate "quick check" of power booster; have students check several vehicles.
6. Have students diagnose malfunctions in a drum or disc brake system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Channel locks, assorted hand jacks, jack stands, air impact wrenches, and assorted brake adjusting tools.
2. Brake drum puller, brake drum micrometer, side cutting pliers (Dykes), and hub cap remover/replacer.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 2, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

AUDIOVISUAL MATERIAL

"Brake Fundamentals." Ford Motor Co., Training and Publications Depart., 912 Parklane Tower West, Dearborn, Michigan 48126.

"Brakes--Inspecting and Adjusting." Gould, Inc., Educational Systems Div., 4423 Arden Dr., El Monte, CA 91731.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.10.1 **TASK:** Test vacuum power booster.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a hydraulic brake power unit, tools, equipment and service manuals,

EVALUATION: test the unit according to manufacturer's procedures and specifications.

STANDARD: Upon completion, the degree of serviceability must be correctly stated and all defects identified.

STUDENT LEARNING EXPERIENCES:

1. Explain the operation of the vacuum gauge.
2. Explain the operation of the vacuum power booster.
3. Describe symptoms of power booster malfunctions.
4. Describe procedures for testing booster.
5. Describe "quick check" of booster.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the types, operation, and testing of power boosters.
2. Disassemble and display a discarded booster.
3. Demonstrate "quick check" of power booster.
4. Have students read test procedure and test a power booster.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vacuum gauge, and vacuum pump.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 2, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.11 **TASK:** Removes and replaces brake shoes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with worn brake shoes, tools, equipment, and service manuals,

EVALUATION: remove and replace the brake shoes according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there must be no drag or pull to one side during brake application, and pedal must be at manufacturer's specified height.

STUDENT LEARNING EXPERIENCES:

1. Adjust brake shoes.
2. Clean and lubricate backing plate and adjusting devices.
3. Inspect and replace wheel seals.
4. State location of primary and secondary shoes.
5. Use special brake repair tools.
6. Diagnose causes of excessive wear.
7. Explain hazards in cleaning with blow gun.
8. State criteria for rejection due to wear.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss ailments caused by asbestos dust.
2. Have students draw a sketch to show location of primary and secondary shoes.
3. Discuss reasons for abnormal brake shoe wear and corrective action necessary.
4. Demonstrate removal, inspection, and replacement of front wheel seals.
5. Demonstrate removal, replacement, and use of special tools in brake shoe service.
6. Discuss causes of abnormal wear and diagnostic procedures to detect wear problems.
7. Discuss wear limits.
8. Have students remove and replace brake shoes in conjunction with a brake job.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Channel locks, assorted hand jacks, jack stands, air impact wrenches, and assorted brake adjusting tools.
2. Brake drum puller, side cutting pliers, brake spring pliers, brake hold-down spring tool, and hub cap remover/replacer.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 4, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 55 and 56. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 30. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 47. 1986.

AUDIOVISUAL MATERIAL

"Bendix Brake Service." Mt. San Jacinto College, Multi-Media Ofc., 21400 Hwy 79, San Jacinto, CA 92383.

"Brake Shoe Grinder." Mt. San Jacinto College.

"Removing Drum Type Brake Linings." Prentice Hall Media, Auto Code VL 235, 150 White Plains Rd., Tarrytown, NY 10591.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.12 **TASK:** Replaces disc brake pad(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 10.6

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.13 **TASK:** Removes, reconditions, and replaces a tandem master cylinder.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective master cylinder, tools, equipment and service manuals,

EVALUATION: remove, recondition and replace the master cylinder according to manufacturer's procedures and specifications.

STANDARD: Upon completion, brake pedal must be firm, must be at correct height, and must not fade. Brake warning light must be off.

STUDENT LEARNING EXPERIENCES:

1. Disconnect hydraulic lines.
2. Recondition master cylinder bore.
3. Bleed master cylinder.
4. Remove and replace all components of master cylinder.
5. Adjust push rod length.
6. Bleed system.
7. Explain reasons for sponginess, fade, leakage into passenger compartment, and other common defects.
8. Recenter brake warning light actuating device.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss defects of master cylinder, symptoms of the defects, and diagnostic methods to detect the defects.
2. Have students overhaul a master cylinder and bleed system.
3. Demonstrate removal, reconditioning, and replacement of a master cylinder.
4. Have students disassemble and reassemble a discarded master cylinder and explain the function of each component.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Brake bleeder, basic hand tool set and brake cylinder hone.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 56.29. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

AUDIOVISUAL MATERIAL

"Master Cylinder Service." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

"Rebuilding a Dual Piston Master Cylinder." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, New York 10591.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.14 **TASK:** Repairs or replaces hydraulic power brake unit.

PERFORMANCE OBJECTIVE:

Reference - Competency 10.10

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.15 **TASK:** Repairs or replaces hydraulic control valve.

PERFORMANCE OBJECTIVE:

Reference - Competency 10.18

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.16 **TASK:** Repairs or replaces hydraulic line(s) and fitting(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 10.18

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.17 **TASK:** Repairs brake hose(s) and line(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 10.18

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.18 **TASK:** Replaces hoses, lines, and fittings.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with hydraulic brakes, tools, equipment, replacement parts, and service manuals,

EVALUATION: remove and replace the hydraulic brake lines, hoses and fittings according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there must be no leaks in the hoses, lines and fittings and fluid level must be at manufacturer's specified height.

STUDENT LEARNING EXPERIENCES:

1. Locate all brake lines, hoses, and fittings.
2. Bleed hydraulic brakes.
3. Use line wrenches.
4. State criteria for replacement of flexible hydraulic hoses.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss reasons for replacement of steel and flexible hoses.
2. Place vehicle on lift; have students locate all hydraulic lines and components.
3. Demonstrate removal and replacement of flexible hoses.
4. Have students replace lines and hoses.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Brake bleeder, vehicle lift, basic hand tool set, and brake fluid.

RESOURCES:

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

10.0 **COMPETENCY/SKILL:** Maintains and repairs braking system(s).

10.19 **TASK:** Removes, reconditions, and replaces a wheel cylinder.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective brake wheel cylinder, tools, equipment and service manuals,

EVALUATION: rebuild the wheel cylinder according to manufacturer's recommended procedures and specifications.

STANDARD: Upon completion, the wheel cylinder must not leak and the brake pedal must be firm.

STUDENT LEARNING EXPERIENCES:

1. Use wheel cylinder hones or steel wool to recondition.
2. Use line wrenches.
3. Remove/replace shoes and bleed system.
4. State limits for allowable bore increase.
5. State criteria that necessitates replacement rather than conditioning.
6. Recenter warning light acturator.
7. Demonstrate procedure for locating a defective wheel cylinder.
8. Explain possible malfunctions of wheel cylinders.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Demonstrate removal, reconditioning, and replacement of wheel cylinders.
2. Discuss causes for brake rejection other than those that reconditioning would eliminate.
3. Discuss procedures to detect a leaking wheel cylinder.
4. Demonstrate reconditioning.
5. Have students recondition a brake cylinder.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, brake bleeder wrench, brake fluid dispenser or power bleeder, brake cylinder hone, brake pressure bleeder, diaphragm type, and channel locks.
2. Air impact wrenches, assorted brake adjusting tools, brake drum puller, side cutting pliers (Dykes), brake spring pliers, brake hold-down spring tool, hub cap remover/replacer, assorted hand jacks and jack stands.

RESOURCES:

Barkhouse, Robert. ENGINE REPAIR--HEAD ASSEMBLY AND VALVE GEAR. McKnight Publishing Co., Inc., Bloomington, IL. Chapter 3, Part 2. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 56. 1980.

Remling, John. BASICS. John Wiley and Sons, NY. 2ND ED. 19__.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 29. 1982.

AUDIOVISUAL MATERIAL

"Wheel Cylinder Service." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.1 **TASK:** Performs visual inspectins of suspension system.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.2 **TASK:** Balances wheels and tires.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.3 **TASK:** Inspects wheel bearings.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.2

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.4 **TASK:** Adjusts and repacks front wheel bearing(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 9.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.5 **TASK:** Repairs or replaces front wheel bearing grease seal(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 9.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.6 **TASK:** Lubricates ball joints.

PERFORMANCE OBJECTIVE:

Reference - Competencies 9.2, 9.7

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.8 **TASK:** Inspects and repairs front suspension sytem.

PERFORMANCE OBJECTIVE:

Reference - Competency 9.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.9 **TASK:** Adjusts or replaces torsion bars.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with torsion bars, tools, equipment, and service manuals,

EVALUATION: replace or adjust torsion bars according to manufacturer's procedures and specifications.

STANDARD: Upon completion, vehicle height must be + or - 1/4" of manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Inspect front suspension.
2. Explain the design and function of torsion bars on automobile front suspension.
3. Use manufacturer's front end alignment specifications.
4. Demonstrate the ability to measure torsion bar height.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Describe the features of a torsion bar suspension system, using a vehicle on a lift.
2. Discuss the advantages and disadvantages of torsion bar suspension as compared to coil spring suspension.
3. Demonstrate methods for determining when a torsion bar needs adjusting or when another malfunction, such as a bent frame, causes sag.
4. Demonstrate removal and replacement of a torsion bar.
5. Have students measure and adjust torsion bar height.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.
2. Vehicle lift, vehicle height gauge, and tape measure.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 46, Part 1. 1974.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

AUDIOVISUAL MATERIAL

"Torsion Bar Suspension--Servicing." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, New York 10591.

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.10 **TASK:** Inspects and replaces steering damper.

PERFORMANCE OBJECTIVE:

Reference - Competency 11.12

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.11 **TASK:** Replaces front suspension cotnrol arms and bushings.

PERFORMANCE OBJECTIVE:

Reference - Competencies 9.6, 9.7

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

11.0 **COMPETENCY/SKILL:** Maintains and repairs front ends and suspension.

11.12 **TASK:** Inspects and replaces shock absorbers.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, replacement parts, tools, equipment and service manuals,

EVALUATION: inspect, remove, and replace a shock absorber following manufacturer's procedures and specifications.

STANDARD: Defective shock absorbers must be identified, and replacements must be securely attached.

STUDENT LEARNING EXPERIENCES:

1. Describe the purpose and function of a shock absorber.
2. Describe the symptoms of a defective shock absorber.
3. Demonstrate the correct use of the specialized tools for installing and replacing shock absorbers.
4. Use vehicle lift.
5. Demonstrate methods for diagnosing condition of shock absorbers.
6. Explain the difference between heavy-duty and regular shocks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the construction and function of normal and heavy-duty shock absorbers.
2. Sectionalize a discarded shock absorber to illustrate construction and function.
3. Discuss symptoms of defective shock absorbers and demonstrate inspection techniques.
4. Have students inspect and replace front and rear shock absorbers.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Vehicle lift, and basic hand tool set.

RESOURCES:

Billiet, Walter E., and Walter Alley. AUTOMOTIVE SUSPENSION, STEERING, ALIGNMENT AND BRAKES. American Technical Society, Chicago, IL. Chapter 4, Part 1. 1974.

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 52. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 31. 1982.

12.0 COMPETENCY/SKILL: Maintains and repairs cooling system

12.1 TASK: Removes and replaces heater (water) hoses.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a defective heater hose, tools, equipment and service manuals,

EVALUATION: remove and replace the defective hose.

STANDARD: Upon completion, hose and hose connections must not leak and must be routed according to manufacturer's procedure.

STUDENT LEARNING EXPERIENCES:

1. State precautions for preventing damage to heater components.
2. Pressure test cooling system.
3. Demonstrate techniques for determining correct length and diameter of replacement hoses.
4. Describe conditions of heater hoses that warrant replacement.
5. Describe types of hose clamps.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students visit a local jobber and obtain information on heater hose sizes and sizes most commonly used.
2. Discuss common heater hose defects that warrant replacement.
3. Deomstrate hose replacement techniques.
4. Have students replace heater hoses.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Funnel, tape measure, and basic hand tool set.
2. Knife, drain pan, and radiator pressure tester, hose clamp pliers.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 59.16. 1980.

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12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.2 **TASK:** Inspects, adjusts and/or replaces fan belts.

PERFORMANCE OBJECTIVE:

Reference - Competency 1.11

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.3 **TASK:** Pressure tests cooling system.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a liquid cooled engine,
EVALUATION:	pressure test the cooling system including the radiator cap.
STANDARD:	All leaks and cap defects must be identified. Release pressure of the radiator cap must be determined within + or - 2 psi of that identified by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the use of radiator pressure tester.
2. Identify the components of the cooling system.
3. Describe the function of each cooling system component.
4. Describe the operation of the cooling system.
5. Determine serviceability of the overflow tank.
6. Describe safety precautions to be observed.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety hazards involved with fan belts and pressurized cooling systems.
2. Have students locate all components of an engine's cooling system.
3. Discuss the function and operation of the water pump, thermostat, engine bypass, overflow tank, and radiator.
4. Discuss inspection of overflow tank.
5. Demonstrate pressure testing of radiator cap and cooling system.
6. Have students service cooling system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Cooling system pressure tester.

RESOURCES:

AUDIOVISUAL MATERIAL

"Cooling System Service". Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

"How to Service the Cooling System". Bergwall Productions, Inc., 839 Stewart Ave., Garden City, NY 11530.

12.4 **TASK:** Checks coolant operating temperature.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle and thermometer,

EVALUATION: determine the temperature of the cooling solution on engine that has been running for 10 minutes.

STANDARD: Recording must be within + or - 5 degrees of the instructor's reading.

STUDENT LEARNING EXPERIENCES:

1. Demonstrate the use and reading of a cooling system thermometer.
2. Explain safety precautions involved in testing cooling system temperatures.
3. Explain common causes of overheating and diagnostic procedures for detecting each.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review safety precautions.
2. Discuss causes of overheating and diagnostic procedures for isolating each.
3. List damages that may occur from overheating.
4. Demonstrate use of a radiator thermometer.
5. Have students perform a cooling system service.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Radiator thermometer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 22. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraph 16.8. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 20. 1986.

AUDIOVISUAL MATERIAL

"How to Service the Cooling System." Bergwall Productions, Inc., 839 Steart Ave., Garden City, NY 11530.

"Cooling System Service." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.5 **TASK:** Checks coolant freezing point.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a liquid cooled engine at operating temperature and an anti-freeze hydrometer,

EVALUATION: record the freezing point of the cooling solution.

STANDARD: Measured freezing point value must be within + or - 5 degrees of the instructor's reading.

STUDENT LEARNING EXPERIENCES:

1. Describe the various types of anti-freeze.
2. Explain the types and operation of anti-freeze testers.
3. Describe the types of cooling systems: open and closed.
4. Describe safety precautions to be observed when testing freeze point.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss and illustrate open and closed cooling systems.
2. Discuss the advantages and disadvantages of various types of anti-freeze.
3. Discuss the relationship between coolant temperature and pressure.
4. Discuss the meaning of "specific gravity" and the functioning of hydrometers.
5. Demonstrate use of the hydrometer-type anti-freeze tester.
6. Demonstrate use of a refractometer.
7. Have students perform a cooling system service.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Radiator hydrometer or refractometer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 22.6. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraph 16.7. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 20.9. 1986.

AUDIOVISUAL MATERIAL

"Cooling System." Gould, Inc., Educational Systems Div., 4423 Arden Drive, El Monte, CA 91731.

"Cooling System--Principles of Operation and Maintenance." Ford Motor Company, Taining and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 48126.

"Cooling System Service." Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.6 **TASK:** Chemically cleans and flushes cooling system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operable liquid cooled engine, tools equipment, chemical cleaners, and service manuals,

EVALUATION: chemically clean and flush the cooling system following manufacturer's procedures.

STANDARD: Upon completion, system must be free of dirt, the coolant level must be at the manufacturer's specified level and there must be no leaks.

STUDENT LEARNING EXPERIENCES:

1. Identify the types of chemicals used for cleaning cooling systems.
2. Describe the types of equipment used for flushing the cooling system.
3. Demonstrate various methods for cleaning cooling systems.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss and identify various chemicals used for cleaning cooling systems.

2. Discuss cooling system accumulations that can be chemically removed.

3. Demonstrate flushing procedures.

4. Have students clean and flush a cooling system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Back flushing equipment, and cooling system pressure tester.
2. Basic hand tool set.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraphs 22.15-22.17. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraph 16.16. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraph 20.13. 1986.

AUDIOVISUAL MATERIAL

"How to Service the Cooling System." Bergwall Productions, Inc., 839 Steart Ave., Garden City, NY 11530.

12.7 **TASK:** Replaces heater hose(s).

PERFORMANCE OBJECTIVE:

Reference - Competency 12.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

12.8 **TASK:** Replaces radiator hose(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a liquid cooling system, tools, and service manuals,

EVALUATION: replace the upper/lower radiator hoses and pressure test the system according to manufacturer's service procedures.

STANDARD: Upon completion, there must be no leaks when radiator is pressurized, and hoses must be clear of other vehicle parts.

STUDENT LEARNING EXPERIENCES:

1. Identify types of radiator hoses and hose clamps.
2. Identify types of special hose tools used for hose service.
3. Identify conditions necessitating replacement.
4. Pressure test cooling systems.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use sections of discarded radiator hose to illustrate typical defects and construction.
2. Have students inspect a number of vehicles for hose conditions.
3. Demonstrate the use of hose clamp pliers.
4. Use several types of hose clamps to illustrate types; have students discuss advantages and disadvantages.
5. Demonstrate hose connections that do not leak until radiator is pressurized.
6. Have students inspect and replace a radiator hose.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand too set, and radiator pressure tester.
2. Drain pan, and radiator filler.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraphs 22.8. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Paragraphs 19.7 and 20.7. 1986.

12.9 TASK: Replaces variable-speed fan.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle(s) with a variable speed fan, tools, and service manuals,
EVALUATION:	diagnose any fan problems, remove and replace as necessary.
STANDARD:	Variable speed fan must be resotred to operation as specified by the manufacturer and the vehicle should be operable.

STUDENT LEARNING EXPERIENCES:

1. Discuss reasons for variable speed fan(s).
2. Discuss causes of fan failure.
3. Demonstrate variable speed fan removal and replacement.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain reasons for use of variable speed fan.
2. Explain causes of fan failures.
3. Demonstrate variable speed fan removal replacement.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fan wrench (optional), pry bar, belt tension gauge.
2. Timing light (optional), chalk, and fender cover(s).

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapters 21 and 22. 1980.

DIAGNOSIS OF COOLING SYSTEMS. Ford Training and Publication Dept. 1, Course #2700-005.

Manufacturer's service manuals.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.10 **TASK:** Replaces radiators.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools, equipment, and service manuals,

EVALUATION: replace and pressure test radiator according to manufacturer's service procedure.

STANDARD: Upon completion, the radiator and its connecting components must not leak, the coolant level must be as specified by the manufacturer, and the radiator shroud must be secure.

STUDENT LEARNING EXPERIENCES:

1. Describe radiator construction types and designs.
2. Demonstrate pressure testing of cooling system.
3. Replace radiator hoses.
4. Identify types of mounting brackets and fasteners.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss radiator damage that may occur due to loose mounting brackets.

2. Discuss advantages and disadvantages of down-flow and cross-flow, tube and fin, and ribbon cellular radiators.

3. Discuss reasons for a pressure test following each cooling system job.

4. Demonstrate hose removal and replacement.

5. Have students replace a radiator and pressure test it.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, radiator pressure tester.
2. Drain pan, and radiator filler.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraphs 22.18. 1980.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.11 **TASK:** Removes, tests, and replaces thermostat.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given a vehicle, thermostat tester or its equivalent, tools and service manuals,
EVALUATION:	remove the thermostat, test for operation as specified by the manufacturer, replace the thermostat, and pressure test the system.
STANDARD:	Readings must be within + or - 5 degrees of the instructor's readings, there must be no leaks after installation and coolant level must be to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Identify types of thermostats.
2. Explain the operation of a thermostat.
3. Identify the heat range of a thermostat.
4. Identify thermostat locations on an engine.
5. Pressure test a cooling system.
6. Describe the operation of a cooling system.
7. Identify the part of the thermostat on the engine block side.
8. Demonstrate thermostat test procedures.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the functions of a thermostat.

2. Explain the consequences of incorrect thermostat heat range.

3. Use theromostats to illustrate pellet and bellows types and identify the side of the radiator where thermostat is located.

4. Discuss locations for thermostats and reasons for pressure-testing after replacement.

5. Demonstrate testing of a thermostat, using thermometer, beaker, and heat source.

6. Have students remove, test, and replace a thermostat.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Drain pan, radiator filler, and radiator pressure tester.
2. Basic hand tool set, hot plate and container, and thermometer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 22.7. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraph 16.8. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 19. 1986.

AUDIOVISUAL MATERIAL

"Cooling System Service" Mt. San Jacinto College, Multi-Media Office, 21400 Highway 79, San Jacinto, CA 92383.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.12 **TASK:** Tests and replaces coolant pressure cap.

PERFORMANCE OBJECTIVE:

Reference - Competency 12.3

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.13 **TASK:** Replaces water pump.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a liquid-cooling engine, tools, equipment and service manuals,

EVALUATION: replace the water pump and pressure test the system according to manufacturer's specifications.

STANDARD: Upon completion, all parts must be secure and the pump must function according to manufacturer's specifications without leaks or stoppages.

STUDENT LEARNING EXPERIENCES:

1. Identify the parts of a water pump.
2. Explain function of water pump.
3. Identify location of water pump.
4. Pressure test cooling system.
5. Inspect, adjust, and replace fan belts.
6. Remove and replace radiators.
7. Replace radiator hoses.
8. Identify types of water pump failures.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Display and discuss a number of defective water pumps that illustrate construction and typical defects.

2. Show filmstrip listed in Audiovisual Materials.

3. Discuss steps involved in water pump replacement.

4. Have students remove and replace a water pump.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and radiator pressure tester.
2. Drain pan, radiator filler, and drive belt tension gauge.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 22.7. 1980.

Crouse, William H. and Donald L. Anglin. AUTOMOTIVE FUEL, LUBRICATING AND COOLING SYSTEMS. McGraw-Hill Book Co., Novato, CA. 6TH ED. Paragraph 16.8. 1981.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 19. 1982.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 19. 1986.

AUDIOVISUAL MATERIAL

"The Engine's Overtaxed Heart--Water Pump Problems and Maintenance". Dana Corp., 5511 E. Main St., Hagerstown, IN 47346.

12.0 **COMPETENCY/SKILL:** Maintains and repairs cooling system.

12.14 **TASK:** Solder minor leaks in radiator.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, tools and equipment,

EVALUATION: locate and repair any small leaks in radiator.

STANDARD: Upon completion, there will be no leaks.

STUDENT LEARNING EXPERIENCES:

1. Define parts of a radiator.
2. Discuss reason for using acid core solder.
3. Demonstrate repair of minor radiator leaks.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Explain parts of radiator.
2. Demonstrate use of cooling pressure tester.
3. Explain proper cleaning and preparation of leaking radiator.
4. Demonstrate solder repair of small radiator leaks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, large tipped soldering iron, acid core solder, and small wire brush.
2. Cooling system pressure tester, and drain pan.

RESOURCES:

AUTOMOTIVE ENCYCLOPEDIA. Taboldt/Johnson and Goodheart-Wilcox, South Holland, IL. Pages 111-125. 19__.

12.15 **TASK:** Replaces freeze plug(s).

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle, parts, tools, and equipment,

EVALUATION: all defective core plugs should be replaced.

STANDARD: Upon completion, cooling system will be full of coolant and core plugs will be free of leaks when pressure tested and inspected by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Describe origin of "core" freeze plugs.
2. Demonstrate proper use of cooling system pressure tester.
3. Evaluate anti-freeze state.
4. Describe proper mixing of anti-freeze and water solution, and why anti-freeze is used.
5. Remove and replace freeze plug(s).

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss reasons for using anti-freeze and how it is mixed.
2. Demonstrate use of cooling system pressure tester, stress not to use on hot engine.
3. Demonstrate use of cooling system hydrometer.
4. Discuss reasons for freeze plugs in engine.
5. Demonstrate removal and replacement of freeze plugs.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, freeze plug driver set, fender covers, cooling system pressure tester, and safety glasses.
2. Long drift punch, 5 qt. (large) drain pan, floor jack and jack stands, and funnel.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 21 and 22. 1980.

AUDIOVISUAL MATERIAL

"Cooling Systems Explained". Bergwall Productions, Inc.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.1 **TASK:** Recharges system, using pound cans.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning system, tools, equipment, pound cans of refrigerant and service manuals,

EVALUATION: recharge an air conditioning system with pound cans of refrigerant to manufacturer's specifications.

STANDARD: Upon completion, system will contain correct amount of refrigerant according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Connect gauge set into system, evacuate system, and leak-test system.
2. Attach pound cans to manifold gauge set.
3. Purge hoses.
4. Warm cans to reduce transfer time.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss safety precautions for charging using pound cans.

2. Remove the top from a 55 gallon drum and make a heavy steel plate to cover top; connect a pound can to the high side of the sytem. Place can, connected to high side, in drum; put top on and weight it; start vehicle and turn on air conditioner; violent explosion will vividly demonstrate major precaution necessary.

3. Demonstrate charging procedures.

4. Have students recharge or "top off" several air conditioning systems.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Assorted wrenches, fender covers, safety glasses/goggles, and manifold gauge set.
2. Vacuum pump, refrigerant oil, leak detector, and service valve wrench.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Paragraph 58.21. 1980.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1982.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.2 **TASK:** Leak tests an air conditioning system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning system, tools, equipment and service manuals,

EVALUATION: detect leaks in an air conditioning refrigerant system.

STANDARD: All leaks must be detected to the instructor's satisfaction.

STUDENT LEARNING EXPERIENCES:

1. Use a propane leak detector.
2. Use an electronic leak detector.
3. Explain the visual indications of a leak.
4. Stabilize a system for leak testing.

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SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss advantages and disadvantages of propane and electronic leak detectors.

2. Discuss detection of leaks by visual means.

3. Show filmstrip LEAK TESTING, EVACUATING AND CHARGING THE SYSTEM.

4. Demonstrate use of leak detectors.

5. Have students practice use of leak detectors.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Manifold gauge set, leak detector; propane or electronic.
2. Refrigerant R-12, Schrader valve tool, service valve wrench, and safety glasses/goggles.

RESOURCES:

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1982.

AUDIOVISUAL MATERIAL

"Leak Testing, Evacuating and Charging the System." Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, New York 10591.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.2.1 **TASK:** Connects a manifold gauge set into system and measure refrigerant pressure.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning unit, tools, equipment and service manuals,

EVALUATION: connect gauge set to system, purge gauge set and measure system pressures.

STANDARD: Correctly state manufacturer's specifications to + or - 3 psi, connect gauges and readings must be within + or - 1 psi of those obtained by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Describe operation of various service valves.
2. Differentiate between low pressure and high pressure sides of system.
3. Remove gauge port caps.
4. Connect manifold gauge service hose to low and high side of compressor.
5. Purge hoses and manifold.
6. Demonstrate safety precautions involved in connecting a manifold gauge set.
7. Describe how R-12 differs from other refrigerants.
8. Explain how to store gauge set.
9. Explain problems caused by air or water in the system.
10. Explain the function of each component of an air conditioning system.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use air conitioning mock-up or vehicle to explain function of each component.

2. Discuss difference between R-12 and R-22 and reasons for not substituting one for the other.

3. Discuss problems caused by air or water in the system.

4. Demonstrate storage procedures for gauge set to minimize contaminants.

5. Demonstrate connection of gauge set to high and low sides of air conditioner.

6. Have students practice connection of gauge set.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender cover, assorted wrenches, manifold gauge set.
2. Safety glasses, thermometer, and barometer.

RESOURCES:

Crouse, William H. AUTOMOTIVE MECHANICS. McGraw-Hill Book Co., Novato, CA. 8TH ED. Chapter 58. 1980.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1978.

Webster, Jay. AUTO MECHANICS. Glencoe Publishing Co., Encino, CA. 2ND ED. Chapter 50. 1986.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.3 **TASK:** Diagnoses air conditioning malfunctions,

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an air conditioning unit with known malfunctions, tools, equipment, and service manuals,

EVALUATION: identify the malfunctions that exist within the unit.

STANDARD: All malfunctions identified by the instructor must be detected.

STUDENT LEARNING EXPERIENCES:

1. Connect a manifold gauge set into system and leak test.
2. Use information from shop manuals, and texts to diagnose malfunctions identified by pressure and temperature readings.
3. Describe function of each component of an air conditioning system.
4. Describe typical air conditioner malfunctions, symptoms of them, and the diagnostic procedures to locate each malfunction.
5. Define wet and dry bulb temperatures.
6. Determine humidity and barometric pressure.
7. Use charts, barometer, thermometer, and hydrometer to determine normal pressure and temperature readings for test conditions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the function of each component of an air conditioning system, typical defects, and the symptoms of and diagnostic procedures for each defect.

2. Discuss the relationship between barometric pressure, temperature, humidity, and air conditioner pressures and temperatures.

3. Provide students with functional test charts from appropriate air conditioner manual; have students determine atmospheric conditions and state air conditioner pressures and outlet temperatures for normal operation.

4. Make a list of ambient temperature, humidity, and gauge readings, visible defects, and customer complaints; have students state possible causes of each problem.

5. Show filmstrip AIR CONDITIONING THEORY AND PRACTICE.

6. Have students determine cause of malfunction in an air conditioning system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Barometer, thermometer for air conditioning testing, radiator cooling fan, test light, jumper wire, gauge set, service valve wrench, and leak detector, electronic or propane.
2. Basic hand tool set, fender covers, hygrometer, vacuum gauge, safety glasses, manifold gauge set, and vacuum pump, hand operated.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchel Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1978.

AUDIOVISUAL MATERIAL

"Air Conditioning Theory and Practice". Carter Educational Aids, PO Box 16092, Clayton, MO 63105.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.4 **TASK:** Replaces compressor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning unit, tools, equipment and service manuals,

EVALUATION: replace air conditioning compressor according to manufacturer's service procedures.

STANDARD: Upon completion, there must be no leaks, compressor must be securely mounted, drive belt must have correct tension, and air conditioner must operate as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Replace drive belts, adjust oil level, recharge system, and leaktest system.

2. Describe common malfunctions of GM-type and York-type compressors, symptoms of the malfunctions, and diagnostic procedures used to identify them.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students disassemble and reassemble typical rotary and reciprocating compressors.

2. Discuss common defects, symptoms of defects, and diagnostic procedures for both types of compressors.

3. Have students remove and replace a compressor in conjunction with other discharging and recharging tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender cover, safety glasses/goggles, charging station or equivalent components, leak detector and barometer.
2. Thermometer, belt tension gauge, refrigerant oil, and basic hand tool set.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1978.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.5 **TASK:** Removes and replaces compressor shaft seal.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given an air conditioning compressor with a faulty shaft seal, service kit, tools, equipment and service manuals,
EVALUATION:	replace the compressor shaft seal according to manufacturer's specifications.
STANDARD:	When completed, system will not leak and seal installation will meet manufacturer's standards.

STUDENT LEARNING EXPERIENCES:

1. Interpret technical manuals.
2. Use special compressor overhaul tools.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrips listed under Audiovisual Material.
2. Demonstrate removal and replacement of a shaft seal.
3. Use discarded compressors; have students practice shaft seal removal and replacement.
4. Have students replace a shaft seal on an operational compressor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Special compressor overhaul tool set, and basic tool set.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

AUDIOVISUAL MATERIAL

"Installing the Seal: GM-Type Air Conditioning Compressor". Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, New York 10591.

"Removing the Seal: GM-Type Air Conditioning Compressor". Prentice Hall Media.

"Replacing a Front Seal: York Air Conditioning Compressor". Prentic Hall Media.

"Replacing the Seal in a Chrysler Air Conditioning Compressor". Prentice Hall Media.

13.6 **TASK:** Evacuates system, using vacuum pump or charging system.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning unit, tools, equipment, and service manuals,

EVALUATION: evacuate air conditioning system according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there will be no refrigerant remaining in the system and vacuum will be 24 to 26 inches of mercury.

STUDENT LEARNING EXPERIENCES:

1. Use the vacuum pump.
2. Use the charging station.
3. Safely discharge refrigerant.
4. Collect oil during refrigerant discharge and measure the amount collected.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Show filmstrip LEAK TESTING, EVACUATING AND CHARGING THE SYSTEM.

2. Discuss the necessity for complete evacuation and collection of refrigerant oil.

3. Discuss safety considerations in discharging refrigerant.

4. Demonstrate evacuation, using charging station and separate vacuum pump.

5. Have students evacuate a system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender cover, safety glasses/goggles, charging station or equivalent components.
2. Service valve wrench, and container to collect oil.

RESOURCES:

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Stockel, Martin W. AUTO SERVICE AND REPAIR. Goodheart-Wilcox Co., South Holland, IL. Chapter 32. 1978.

AUDIOVISUAL MATERIAL

"Leak Testing, Evacuating and Charging the System". Prentice Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, New York 10591.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.7 **TASK:** Replaces condenser.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning system, tools, equipment and service manuals,

EVALUATION: replace the air conditioning condenser according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there will be no leaks in the condenser and it will not touch the radiator.

STUDENT LEARNING EXPERIENCES:

1. Adjust oil level, recharge system, and leaktest system.
2. Explain reasons for replacing the condenser.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review removal and installation prerequisites.
2. Discuss condenser defects and reasons for its removal and replacement.
3. Have students remove and replace condenser in conjunction with other discharging and recharging tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, safety glasses/goggles, charging station or equivalent components.
2. Leak detector, service valve wrench, and refrigerant oil.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.8 **TASK:** Replaces evaporator in air conditioning unit.

PERFORMANCE OBJECTIVE:

Reference - Competency 13.7

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.9 **TASK:** Replaces dryer.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning system, tools, equipment, and service manuals,

EVALUATION: replace the air conditioning system receiver-dryer according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there will be no bubbles in the sight glass, system will be charged to manufacturer's specifications and no detectable leaks.

STUDENT LEARNING EXPERIENCES:

1. Evacuate system, adjust oil level, recharge system, and leaktest system.
2. Locate the dryer in the system.
3. Explain reasons for charging a dryer.
4. Explain procedures for determining when a dryer needs replacing.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss purpose of dryer, common defects, symptoms of defects, and the diagnostic procedures to identify them.
2. Sectionalize a dryer to illustrate interior configuration.
3. Have students remove and replace dryer in conjunctiion with other discharging and charing tasks.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, safety glasses/goggles, and leak detector.
2. Service valve wrench, and charging station or equivalent components.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.10 **TASK:** Replaces air conditioner fan motor.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with an air conditioning unit, tools, equipment, and service manuals,

EVALUATION: replace the air conditioning fan motor according to manufacturer's service procedure.

STANDARD: Upon completion, the fan motor will operate correctly at all speeds and have no rattles.

STUDENT LEARNING EXPERIENCES:

1. Interpret technical (service) manuals.
2. Demonstrate diagnostic procedures used to determine the condition of the fan motor.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students use service manuals to determine replacement procedures on different vehicle makes and models.
2. Demonstrate techniques to isolate fan motor defects from defects in wiring or control units.
3. Have students replace an air conditioning fan motor.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Manufacturer's service manuals.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.11 **TASK:** Replaces expansion valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational air conditioning unit, tools, equipment, and service manuals,

EVALUATION: replace the expansion valve on unit according to manufacturer's service procedure.

STANDARD: Upon completion, there will be no leaks at the expansion valve and unit will operate according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Adjust oil level, recharge, and leaktest system.

2. Explain the procedures for replacing an expansion valve.

3. Describe typical expansion valve malfunctions and their symptoms.

4. Describe diagnostic procedures used to verify the malfunction.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Review evacuation and recharging procedures.

2. Discuss the function of an expansion valve, typical malfunctions, and the symptoms and diagnostic procedures for each.

3. Have students replace an expansion valve in conjunction with evacuation and recharging of the system.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, fender covers, safety glasses/goggles, leak detector, and service valve wrench.
2. Refrigerant oil, and charging station or equivalent components.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.12 **TASK:** Replaces evaporator control valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning evaporator control valve, tools, equipment, and service manuals,

EVALUATION: replace the evaporator control valve according to manufacturer's procedures and specifications.

STANDARD: Upon completion, there will be no leaks in the repaired area, and the unit will operate according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Adjust oil level, recharge system, and leaktest system.

2. Explain the procedures for replacing a control valve.

3. Demonstrate the procedures for diagnosing a defective control valve.

4. Describe common defects in a control valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss function, defects, symptoms, and diagnositc procedures for various evaporator control valves.

2. Have students remoive and replace a control valve in conjunction with replacement of an expansion valve.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Fender covers, safety glasses/goggles, basic hand tool set, charging station or equivalent components, and leak detector.
2. Service valve wrench, and refrigerant oil.

RESOURCES:

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

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13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.13 **TASK:** Diagnoses and repairs air conditioning electrical circuits.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning air conditioning electrical circuit, tools, equipment and service manuals,

EVALUATION: diagnose and repair the circuit.

STANDARD: Upon completion, unit must operate according to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Locate shorts, opens, and blown fuses.
2. Use voltmeter, ohmmeter, ammeter, and test light.
3. Explain the function of each electrical component of the air conditioning system.
4. Read wiring diagrams.
5. Interpret technical specifications and service manuals.
6. Describe common malfunctions of the electrical components, symptoms of each, and diagnostic procedures to locate malfunctions.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the operation of each electrical component of the system, typical defects, and the diagnostic procedures for each defect.

2. Introduce an electrical malfunction into an air conditioning system; have students locate and correct it.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, ohmmeter, test light, and jumper wire.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

AUDIOVISUAL MATERIAL

"Electricity--Diagnosis." Ford Motor Company, Training and Publications Dept., 912 Parklane Tower West, Dearborn, Michigan 48126.

"Use of Wiring Diagrams." Ford Motor Company.

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13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.13.1 **TASK:** Diagnoses and repairs air conditioning vacuum circuits.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a malfunctioning air conditioning system vacuum circuit, tools, equipment, and service manuals,

EVALUATION: diagnose and repair the vacuum circuit according to manufacturer's procedures and specifications.

STANDARD: Upon completion, the vacuum system will function according to manufacturer's specifications and have no leaks.

STUDENT LEARNING EXPERIENCES:

1. Read and interpret vacuum diagrams.
2. Use a vacuum gauge and pump.
3. Interpret technical publications.
4. Explain the function of each vacuum system device in the system.
5. Describe common vacuum system component failures, symptoms of each, and diagnostic procedures to analyze the malfunction.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the construction, operation, and function of each vacuum-operated unit.
2. Discuss typical defects, symptoms of defects, and diagnostic procedures for vacuum circuit malfunctions.
3. Display and discuss the vacuum-operated components of an air conditioning system.
4. Create vacuum related defects in an air conditioning system; have students repair the defects.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, vacuum pump, and vacuum gauge.

RESOURCES:

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

13.0 **COMPETENCY/SKILL:** Maintains and repairs automobile air conditioning system(s).

13.14 **TASK:** Services air conditioning control cables.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational air conditioning unit, tools and service manuals,

EVALUATION: identify any malfunctions in the control cables and make repairs as needed to meet manufacturer's operating specifications.

STANDARD: Upon completion, the control cables will work smoothly with no binding and be properly adjusted to manufacturer's specifications.

STUDENT LEARNING EXPERIENCES:

1. Explain the operation of air conditioner control cables.
2. Interpret technical (service) manuals.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students use service manuals to distinguish between air conditioner/heater mode and control settings.
2. Demonstrate operation and adjustment of air conditioner control cables.
3. Have students service the control cables on an operational air conditioner.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, assorted lubricants and dispensers.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system.

14.1 **TASK:** Diagnoses on heating system malfunctions.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with known malfunctions in the heating system, tools, equipment and service manuals,

EVALUATION: conduct a performance test on the heating system and identify the malfunctions.

STANDARD: All malfunctions identified by the instructor must be recognized.

STUDENT LEARNING EXPERIENCES:

1. Locate and identify various heater controls.
2. Check coolant temperature and operation of controls.
3. Read wiring and vacuum diagrams.
4. Explain the operation of automatic temperature control.
5. Explain the function of each component of a heater system.
6. Explain the causes of common heating system malfunctions, diagnostic procedures used to isolate each cause, and measures for correcting each malfunction.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss the function and operation of each component of the heating system.

2. Discuss possible defects of each heating system component and the symptoms and diagnostic procedures for each.

3. Have students diagnose the cause of a heating system malfunction.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Radiator thermometer, vacuum gauge, and test light.
2. Ohmmeter, vacuum pump, voltmeter, and basic hand tool set.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Dwiggins, Boyce H. AUTOMOTIVE AIR CONDITIONING. Delmar Publishers, Albany, NY. 5TH ED. Section 3. 1983.

Manufacturer's service manuals.

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14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system.

14.2 **TASK:** Replaces heater defroster hose.

PERFORMANCE OBJECTIVE:

CONDITIONS:	Given an operational heating system with a defective heater/defroster hose, tools, and service manuals,
EVALUATION:	replace the hose according to manufacturer's service procedure.
STANDARD:	Upon completion, there will be no leaks, and hose must be correctly routed.

STUDENT LEARNING EXPERIENCES:

1. Locate defective heater/defroster hoses.
2. Interpret technical (service) manuals.
3. Remove and replace instrument panel.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students select several makes and models of automobiles and use service manuals t determine hose ocations and replacement procedures.
2. Have students replace a defective hose.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Manufacturer's service manuals.

14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system.

14.3 **TASK:** Removes and replaces water control valve.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a faulty water control valve, tools, equipment, and service manuals,

EVALUATION: remove and replace the water control valve.

STANDARD: Upon completion, the valve will function as specified by the manufacturer, and the hoses will not leak and will be correctly routed.

STUDENT LEARNING EXPERIENCES:

1. Locate a defective water control valve.
2. Remove and replace heater hoses.
3. Explain operation of and testing procedures for a water control valve.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Use several water control valves to illustrate location and operation.
2. Discuss water control/valve replacement procedures.
3. Have students replace a water control valve.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and radiator pressure tester.
2. Drain pan, and water control valves.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system(s).

14.4 **TASK:** Removes and repairs or replaces heater core.

PERFORMANCE OBJECTIVE:

Reference - Competency 14.6

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system.

14.5 **TASK:** Services heater control components.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational heating system, tools, equipment, and service manuals,

EVALUATION: service or replace the heater control units according to manufacturer's service procedures.

STANDARD: Upon completion, the heater control units will operate as prescribed in the automobile owners handbook.

STUDENT LEARNING EXPERIENCES:

1. Locate various heater control units.
2. Use vacuum pump and vacuum gauge.
3. Test operation of heater thermostatic control.
4. Test vacuum motors and switches.
5. Read vacuum diagrams.
6. Demonstrate procedures for adjustment of control cables.
7. Explain function and operation of control components.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students test various vacuum devices and vacuum controls.
2. Discuss manually operated and vacuum operated heater controls.
3. Demonstrate procedure for testing thermostatic control device.
4. Have students correct a heater malfunction caused by a defective control unit.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, vacuum gauge, and vacuum pump.

RESOURCES:

AUTOMOTIVE AIR CONDITIONING AND HEATING SERVICE MANUAL. Mitchell Manuals, Inc., San Diego, CA. Current ED.

Manufacturer's service manuals.

14.0 **COMPETENCY/SKILL:** Maintains and repairs automobile heating system.

14.6 **TASK:** Removes and replaces heater core.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given an operational heating system, tools, equipment, and service manuals,

EVALUATION: remove and replace the heater core according to manufacturer's service procedures.

STANDARD: Upon completion, there will be no leaks or damage to the heater and it will perform as specified by the manufacturer.

STUDENT LEARNING EXPERIENCES:

1. Replace heater hoses and pressure test the cooling sytem.
2. Interpret technical (service) manuals.
3. Describe precautions to be taken when removing heater hoses to prevent damage to heater core.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Have students, using service manuals, list removal/replacement procedures for several makes and models of heaters.
2. Demonstrate heater hose removal techniques to prevent heater core damage.
3. Have students remove and replace a heater core.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. Basic hand tool set, and radiator pressure tester.
2. Vehicle lift or jack and jack stands.

RESOURCES:

Manufacturer's service manuals.

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.1 **TASK:** Connects test equipment to vehicle.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.2-7.5, 7.8, 7.14, 7.16, 7.17

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.2 **TASK:** Evaluate test equipment readings.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.5, 7.13, 7.14, 8.3

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.3 **TASK:** Distinguish normal/abnormal analyzer readings.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.17,

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.4 **TASK:** Prepare test reports.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.0 thru 8.22, 2.1

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.5 **TASK:** Analyze vehicle performance malfunctions.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.13, 7.15, 8.3-8.6, 8.14, 8.22

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.6 **TASK:** Replaces defective components in electrical or fuel system.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.0-8.22

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.7 **TASK:** Adjusts ignition system to manufacturer's specifications.

PERFORMANCE OBJECTIVE:

Reference - Competency 7.14

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.8 **TASK:** Adjusts fuel system to manufacturer's specifications.

PERFORMANCE OBJECTIVE:

Reference - Competencies 7.0-8.22

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.9 **TASK:** Obtains vehicle trouble codes.

PERFORMANCE OBJECTIVE:

CONDITIONS: Given a vehicle with a computer controlled engine, tools, equipment, and service manuals,

EVALUATION: obtain stored vehicle trouble codes or determine that no fault exists in computer system.

STANDARD: Test results obtained must be the same as those identified by the instructor.

STUDENT LEARNING EXPERIENCES:

1. Use test equipment.

2. Interpret manufacturer's specifications.

3. Read trouble codes.

SUGGESTED INSTRUCTIONAL TECHNIQUES:

1. Discuss computer controlled combustion systems, electronic engine control systems, leave burn combustion control systems.

2. Explain methods of receiving trouble codes from computer systems.

3. Stress importance of using proper test equipment and procedures recommended by manufacturer to prevent damage to computer systems.

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

1. A vehicle using on-board electric engine computer.
2. Manufacturer's service specifications.
3. Necessary test equipment or tools.
4. Jumper wires.

RESOURCES:

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15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.10 **TASK:** Clears trouble codes.

PERFORMANCE OBJECTIVE:

Reference - Competencies 8.19, 8.20

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

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15.0 **COMPETENCY/SKILL:** Engine performance diagnosis, driveability and repair.

15.11 **TASK:** Retests vehicle.

PERFORMANCE OBJECTIVE:

Reference - Competencies 8.19, 15.9

CONDITIONS:

EVALUATION:

STANDARD:

STUDENT LEARNING EXPERIENCES:

SUGGESTED INSTRUCTIONAL TECHNIQUES:

INSTRUCTIONAL EQUIPMENT, MATERIALS, AND SUPPLIES:

RESOURCES:

BASIC HAND TOOL SET

8" diagonal cutter
8" slip-joint pliers
6" needle-nose pliers
1/4" drive set with sockets & drives (14 pcs., standard, 6 pt., 3/16" - 9/16")
brake-spring pliers
angle-nose battery pliers
standard 3/8" drive socket set, sockets only (6 pt., 11 pcs., deep 1/4" - 7/8")
standard 3/8" drive socket set, with sockets & drives (12 pt., 18 pcs., 1/4" - 7/8")
prybar, 16"
tune-up kit for Kettering & solid state systems (14 pcs.)
radiator hose tool
"L" hex wrench set (15 pcs., 0.0028" - 7/16")
brake shoe spring tool
brake adjusting tool (B1461)
brake bleeder wrench (B1463A)
brake adjusting tool (B3404B)
plastic tip hammer, 16 oz.
ball-peen hammer, 12 oz.
ball-peen hammer, 20 oz.
battery clamp puller
battery post cleaner
circuit tester (2-18 volt) lamp- & probe-type
8-wire gap gauge (.022" - .040")
25-blade feeler gauge (.0015" - .025")
Corbin hose clamp pliers
hacksaw frame
standard long combination wrench set (9 pcs., 12 pt., 5/16" - 3/4"
chisel-edge scraper
punch & chisel set (11 pcs.)
ratcheting "Boxocket" (6 pt., 1/4" - 1-1/4", 7 pcs.)
open end/flare nut wrench set (5 pcs., 3/8" - 5/8")
brake bleeder wrench (S8184)
3/8" drive spark plug flexocket (13/16")
3/8" drive spark plug flexocket (5/8")
standard & Phillips screwdriver set (8 pcs.)
1/4" drive flexible adjusting wrench
1/4" drive hex head driver (1/8")
standard vise-grip pliers
box wrench set (10 pcs., 12 pt., 3/8" - 1")
3/8" drive socket set, sockets only (6 pt., 6 mm - 17 mm, 12 pcs., metric)
3/8" drive socket set, sockets only (12 pt., deep, 10 to 21 mm, 12 pcs., metric)
"L" hex wrench set (2 mm - 12 mm, 11 pcs., metric)
wrench set, combination (1/4" - 5/8", 7 pcs., standard, short)
wrench set, combination (10 mm - 19 mm, 10 pcs., metric)
fuse remover/installer

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"Spotting a Breakdown Before It Happens"; "Survival Training for Road Breakdown"; "Good Miles Per Gallon Add Up to Real Dollars"; "How to Buy, Sell or Trade a Car"; "Steering and Suspension Systems--Functions"; "The Electrical System"; "The Cooling System"; "The Ignition System"; "The Spark Plugs"; "The Breaker-type Ignition System"; "Troubleshooting the Stalled Car"; "Servicing the Alternator"; "Servicing the Automobile Starters" (4 filmstrips and cassettes); "Servicing the Ford Electronic Ignition Distributor"; "Troubleshooting the Ford Electronic Ignition System"; "Servicing the Chrysler Electronic Ignition Distributor"; "Troubleshooting the Chrysler Electronic Ignition System"; "Servicing the GM Electronic Ignition Distributor"; "Troubleshooting the GM Electronic Ignition System"; "Removing the Seal: GM-type Air Conditioning Compressor"; "Installing the Seal: GM-type Air Conditioning Compressor"; "Replacing the Front Seal in a Chrysler Air Conditioning Compressor"; "Replacing a Front Seal: York Air Conditioning Compressor"; "Leak Testing, Evacuating and Charging the System"; "C-4 Transmission--Bench Evaluation"; "C-4 Transmission--Removing Internal parts"; "C-4 Transmission--Disassembling and Inspecting the Front Pump and Forward Part of the Gear Train"; "C-4 Transmission--Cleaning, Inspecting and Assembling the Governor"; "C-4 Transmission--Reassembling the Rear Section of the Gear Train"; "C-4 Transmission--Rebuilding the Extension Housing Assembly"; "C-4 Transmission--Installing the Forward Section"; "C-4 Transmission--Completing the Assembly"; "Automatic Transmissions--Changing Transmission Fluid"; "Automatic Transmission--Troubleshooting"; "Standard Transmission--Removing the Mainshaft Gear Assembly"; "Standard Transmission--Servicing the Reverse, Idler and Counter Gears"; "Standard Transmission--Servicing the Mainshaft Gear Assembly"; "Standard Transmission--Completing the Assembly"; "Removing a Clutch"; "Installing a Clutch"; "Removing and Disassembling a Drive shaft and U-joints"; "Assembling U-joints and Installing the Drive Shaft"; "Replacing the Differential Pinion Shaft Oil Seal"; "Replacing the "C" Lock Type Axle Seal"; "Replacing the "B" Type Axle Seal"; "The Hydraulic Brake System: An Overview"; "Rebuilding a Dual Piston Master Cylinder"; "Removing Drum Type Brake Linings"; "Replacing Seals in a Single-Piston Caliper"; "Wheel Balancing--Spin and Bubble"; "Torsion Bar Suspension--Servicing"; "Upper Load--Carrying Ball Joints: Inspection and Replacement"; "Wheel Alignment: Analyzing and Adjusting"; "Repacking Front Wheel Bearings"; "Lower Load--Carrying Ball Joints: Inspection and Replacement"; "Servicing the Rochester Single Barrel Carburetor"; "Servicing the Holley Single Barrel Carburetor";

"Servicing the Carter Single Barrel Carburetor"; "Factors Affecting Curb Idle Adjustments"; "Introduction to the Diesel Engine"; "Diesel Engine Operating Principles"; "Cylinder Head and Pan Removal"; "Cylinder Ridge and Piston Removal"; "Engine Block Inspection and Preparation"; "Crankshaft Inspection and Installation"; "The Piston: Disassembly, Cleaning and Inspection"; "The Piston: Assembly and Installation"; "Installation of Camshaft and Timing Chain"; "The Flywheel and Oil Pump"; "Completing Engine Assembly"; "Cylinder Head: Disassembly, Cleaning and Inspection"; "Grinding Valves"; "Servicing Valve Guides and Seats"; "Reassembling the Cylinder Head"; "Wrenches: Identification and Use"; "Using Screwdrivers, Pliers and Hammers"; "Working with Nuts and Bolts"; "Working with Steel and Copper Tubing"; "Working with Hoses"; "Using Basic Power and Test Equipment"; "Automobile Battery Service"; "Repairing a Puncture in a Radial Tire"; "Electric Wiring Procedures"; "Oil Change and Lubrication"; "Light Bulb Service"; "The Four-Stroke-Cycle Internal Combustion Engine"; "Engine Components: Functions"; "Valve Mechanisms and the Two-Stroke-Cycle"; "The Fuel System"; "The Lubricating and Cooling System"; "You, the Service Station Attendant"; "So You Want to Work in an Auto Parts Dealership"; "Your Job as an Auto Mechanic". (Filmstrips and Cassettes.) (These same programs are available from Teaching Aids, Inc., Box 1798, Costa Mesa, CA 92626.) Prentice-Hall Media, Auto Code VL 235, 150 White Plains Road, Tarrytown, NY 10591.

"Frontiers of Friction"; "Drama of Metal Forming". (16 mm films.) Shell Oil Company, Film Library, 450 N. Meridian Street, Indianapolis, IN 46204.

"Introduction to Auto Shop Safety". (Filmstrip and Cassette.) The 2000 Company, Box 1055, Costa Mesa, CA.

"Professional Development in Auto Mechanics". (Filmstrip and Cassette.) Vocational Industrial Clubs of America, P.O. Box 3000, Leesburg, VA 22075.

"Servicing Brakes for Safety". (16 mm Motion Picture.) "Disc Brake Service, Floating Caliper, Single Piston Type". (Slide-cassette Presentation.) Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, MO 63133.